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Draft Environmental Impact Statement
City of Los Angeles Wastewater
Facilities Plan. Chapters I and II

Los Angeles City Dept. of Public Works, CA

Prepared for

Environmental Protection Agency
San Francisco, CA

Sep 77

U.S. Department of Commerce
National Technical Information Service

NTIS

PB82-190216

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DRAFT

ENVIRONMENTAL IMPACT STATEMENT CITY OF LOS ANGELES WASTEWATER FACILITIES PLAN

EPA–9–CA–Los Angeles–LA City–WWTP & INT–77

Chapters I and II

September 1977

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This EIS presents information to the public to assist in the decisionmaking process; it highlights the environmentally sensitive areas in the City of Los Angeles and its metropolitan region; it defines the role that wastewater treatment alternatives play in changing the existing environment of these areas; it evaluates the potential for water reclamation and conservation, evaluates and recommends a list of feasible alternatives ranked according to their environmental impacts, either positive or negative, and suggests mitigative measures that will allow maintenance of water quality and expansion to meet future needs without adversely affecting the social, biological, and physical environment of Los Angeles. The major environmental issues identified are: Total Sewage System Capacity - What additional sewage capacity should be provided for and what are the primary and secondary effects of providing this capacity? Location - Where should the additional capacity be located for cost effective wastewater treatment with minimal environmental impacts? Ocean Discharge - What changes will result in the nature of wastewater constituents entering the Pacific Ocean and what will be the effects of these changes? Reclamation - What are the values, feasibility, and environmental impacts of measures designed to conserve and utilize wastewater and its components through reclamation?

Land

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Regional Planning
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IMPACT STATEMENT
CITY OF LOS ANGELES
WASTEWATER FACILITIES PLAN

September 1977

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DRAFT
ENVIRONMENTAL IMPACT REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
CITY OF LOS ANGELES
WASTEWATER FACILITIES PLAN

SEPTEMBER 1977

PREPARED BY:

CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING
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LOS ANGELES, CALIFORNIA 90012

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100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

SEP 01 1977

To All Interested Agencies, Public Groups, and Concerned Individuals:

We submit for your review and comment the Draft Environmental Impact Statement/Environmental Impact Report for the City of Los Angeles Wastewater Treatment Facilities Plan. This statement has been prepared in compliance with the National Environmental Policy Act of 1969 (P.L. 91-190), and implementing regulations promulgated by the Council on Environmental Quality and the Environmental Protection Agency. It has also been prepared in compliance with the California Environmental Quality Act and its implementing regulations.

The EIS/EIR summary and full report present the environmental, economic and social effects of wastewater facility planning decisions which will affect over 3.4 million persons living in the City of Los Angeles and contract cities, and involve capital costs in excess of 300 million dollars over the next five years.

The main purpose of this document is to publicize the long range environmental and social effects of wastewater facility alternatives so that citizens and governmental agencies can comment and express their concerns and preferences. Public comments are expected to play a key role in (1) selection of long-range alternatives for the service area, including size and location of collection and treatment facilities, and (2) implementation of measures needed to reduce adverse environmental effects.

The Environmental Protection Agency, Region IX and the City of Los Angeles, Bureau of Engineering will hold hearings on the Draft EIS, approximately 30 days following the distribution of the EIS. The exact place and date will be announced. All interested parties are invited to express their views at the hearings. Persons wishing to make comments may submit them in writing and/or appear at the hearings. Oral statements will be considered, but, for the record, all important testimony should be submitted to:

Environmental Protection Agency, Region IX
Attn: Fred Krieger, W-1
100 California Street
San Francisco CA 94111

Enough copies of the written material should be provided so that other interested parties at the hearing may receive a copy. Oral statements should summarize extensive written material since it is necessary for all interested parties to be heard. After the public hearings the Draft EIS/EIR will be revised in light of the comments to form the Final EIS/EIR.

If you do not comment at the public hearings, you may send written comments to EPA at the address given above within thirty days following the hearings.

The following documents constitute the EIS:

Mini-Summary
General Summary
Main text (3 volumes)
Addendum 1. Reclamation Options
Addendum 2. Environmental Analysis of Reclamation
Addendum 3. Interim Sludge Processing and Disposal System
Appendices

Copies of these documents can be obtained by written or by telephone requests at the address given above or at:

City of Los Angeles, Bureau of Engineering
City Hall East-Room 650
200 North Main Street
Los Angeles CA 90012 Attn: Fred Hoeptner
(213)485-3089

Additionally the Draft EIS and supplemental information may be reviewed at the above addresses or at the public libraries within the service area of the City of Los Angeles.

Please bring this notice to the attention of all persons who would be interested in this matter.

Sincerely,

Sheila M. Prindiville
for Paul De Falco, Jr.
Regional Administrator

PREPARATION OF THE EIS/EIR

LIST OF PARTICIPANTS

This Draft EIS/EIR was prepared under the auspices of the Environmental Protection Agency, Region IX. EPA staff was supported by the State Water Resources Control Board (SWRCB), the independent consulting firm of Henningson, Durham & Richardson, Inc., and the City of Los Angeles. The following persons participated in the development of this EIS/EIR:

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CITY OF LOS ANGELES

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A. background of the EIS

I-1

A. BACKGROUND OF THE EIS

This Draft Environmental Impact Statement (EIS) is designed to accompany the City of Los Angeles Wastewater Facilities Plan, a 25-year plan for the future of the City's sewerage system. The EIS describes the existing physical, biological, and socioeconomic characteristics of the City of Los Angeles (Chapters II and III); reviews applicable legislation (Chapter IV); describes existing problems, facilities, and proposed solutions (Chapters V, VI, and VII); identifies potential environmental impacts that could be caused by implemention of alternative facility plans (Chapters VIII and IX); and identifies measures that could minimize the negative impacts (Chapter X). The Draft EIS document undergoes public review and comments prior to preparation of a Final EIS.

The EIS process is conceptualized in Figure I-1. The process includes a review of available literature and a compilation of pertinent data for analysis. Those mitigative measures with probable benefit and minimal negative effect are identified for possible adoption. This document is prepared and issued by the Environmental Protection Agency so that the public and decisionmakers within the City, State, and Federal governments will have in-depth analyses of the environmental effects before decisions are made. Thus, the EIS is an integral part of the decisionmaking and grant-funding process.

Figure I-2 identifies the three main decision steps in the development of the Facilities Plan and the construction of facilities for wastewater treatment: those leading to the Step 1 Grant for planning, the Step 2 Grant for engineering design and specifications, and the Step 3 Grant for construction. Operation and maintenance of the completed facilities are the responsibility of the City of Los Angeles, although the guidelines for operation and maintenance are part of the grant process.

The City of Los Angeles Facilities Plan is designed to project City sewage treatment needs through the year 2000 and to identify the alternative treatment processes, plant locations, and facilities modifications and additions necessary to meet those needs. The City is providing this plan in response to specific federal and State requirements for upgrading the quality of the treated wastewater discharged to receiving waters and for disposing of the waste treatment by-product known as sludge. The City has also developed a number of facilities modifications or additions designed to satisfy flow and treatment capacity requirements over the 25-year project period.

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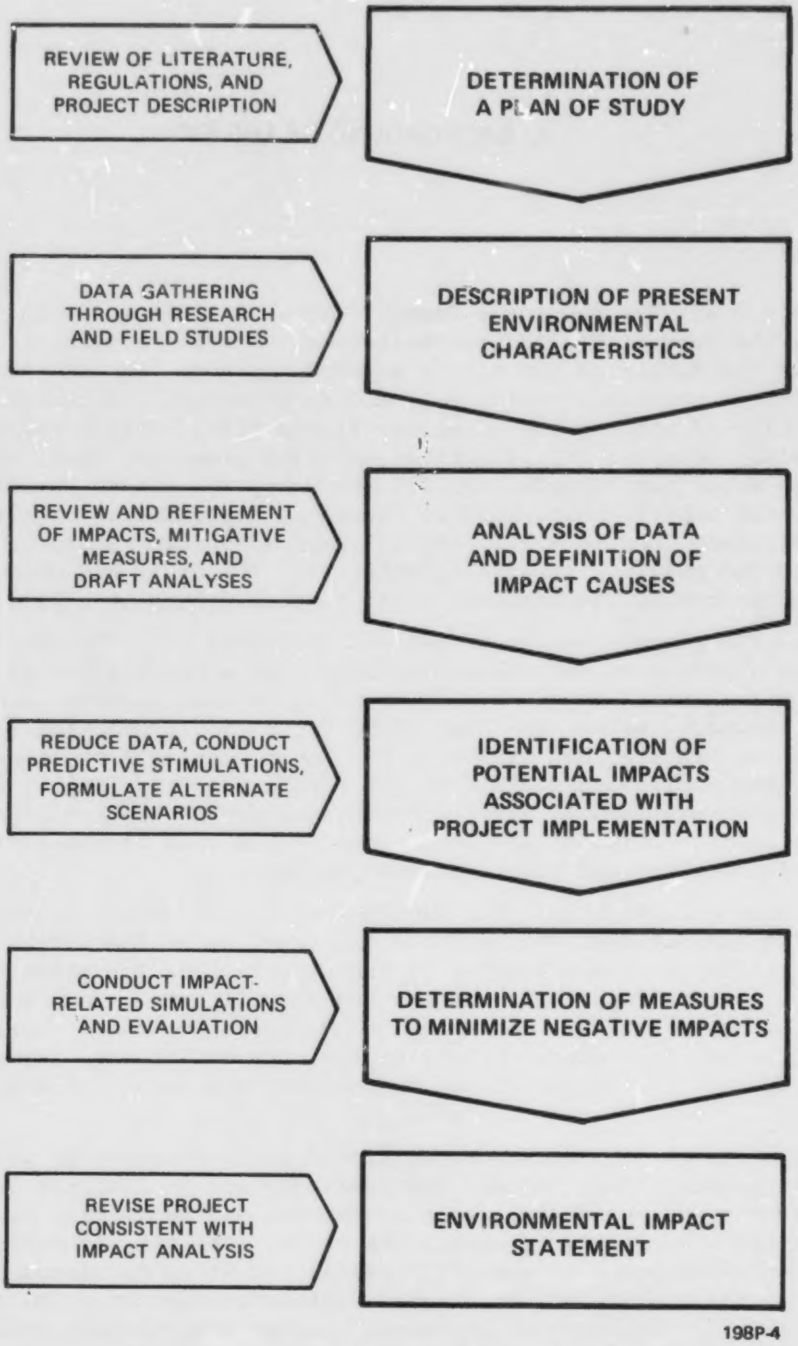
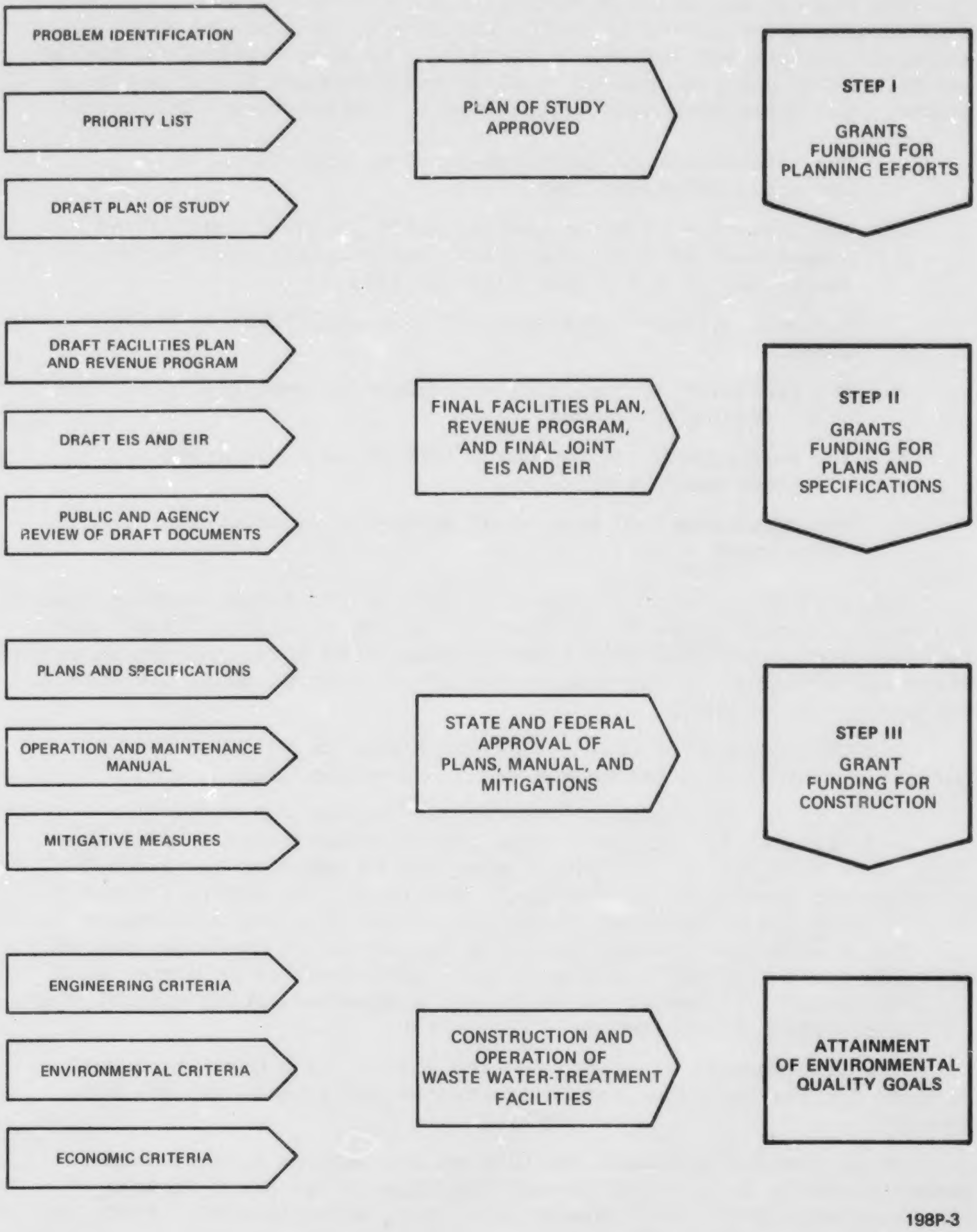

REVIEW OF LITERATURE, REGULATIONS, AND PROJECT DESCRIPTION
DETERMINATION OF A PLAN OF STUDY
DATA GATHERING THROUGH RESEARCH AND FIELD STUDIES
DESCRIPTION OF PRESENT ENVIRONMENTAL CHARACTERISTICS
REVIEW AND REFINEMENT OF IMPACTS, MITIGATIVE MEASURES, AND DRAFT ANALYSES
ANALYSIS OF DATA AND DEFINITION OF IMPACT CAUSES
REDUCE DATA, CONDUCT PREDICTIVE STIMULATIONS, FORMULATE ALTERNATE SCENARIOS
IDENTIFICATION OF POTENTIAL IMPACTS ASSOCIATED WITH PROJECT IMPLEMENTATION
CONDUCT IMPACT-RELATED SIMULATIONS AND EVALUATION
DETERMINATION OF MEASURES TO MINIMIZE NEGATIVE IMPACTS
REVISE PROJECT CONSISTENT WITH IMPACT ANALYSIS
ENVIRONMENTAL IMPACT STATEMENT
198P-4

Figure I-1. Conceptual flow of the Environmental Impact Statement process.


PROBLEM IDENTIFICATION
PRIORITY LIST
DRAFT PLAN OF STUDY
PLAN OF STUDY APPROVED
STEP I
GRANTS FUNDING FOR PLANNING EFFORTS
DRAFT FACILITIES PLAN AND REVENUE PROGRAM
DRAFT EIS AND EIR
PUBLIC AND AGENCY REVIEW OF DRAFT DOCUMENTS
FINAL FACILITIES PLAN, REVENUE PROGRAM, AND FINAL JOINT EIS AND EIR
STEP II
GRANTS FUNDING FOR PLANS AND SPECIFICATIONS
PLANS AND SPECIFICATIONS
OPERATION AND MAINTENANCE MANUAL
MITIGATIVE MEASURES
STATE AND FEDERAL APPROVAL OF PLANS, MANUAL, AND MITIGATIONS
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ENGINEERING CRITERIA
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ATTAINMENT OF ENVIRONMENTAL QUALITY GOALS
198P-3

Figure I-2. Decisionmaking and grant-funding process for sewage treatment facilities.

The Federal Act which governs planning for wastewater facilities construction grant monies is Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. The objectives of PL 92-500 are to restore and preserve the quality and abundance of the nation's waters. Six goals have been established to achieve these objectives:

1. The elimination of the discharging of pollutants to navigable waters by 1985.
2. The provision of water quality which protects and fosters propagation of fish, shellfish, and wildlife, and allows recreation in and on the water by 1983.
3. The prohibition of discharge of toxic pollutant in toxic amounts.
4. The provision of financial assistance to construct publicly-owned treatment systems.
5. The development and implementation of areawide waste treatment management plans.
6. The development of technology necessary to carry out these goals.

Two basic laws applicable to the State of California further specify the actions and programs to be developed in the Facilities Plan: the Federal Water Pollution Control Act Amendments of 1972, and the California State Porter-Cologne Water Quality Act of 1970 (Water Code, Division 7, Section 13000, *et seq.*).

The City Council of Los Angeles set forth its policy on water pollution control in a resolution dated 6 December 1956:

> . . . it is the policy of the City of Los Angeles to provide and maintain facilities for the treatment and disposal of sewage which shall be, at all times, adequate in capacity and adequate for the protection of the public health and the public interests in this and neighboring communities, including the maintenance of the beaches and coastal waters in an attractive condition suitable for recreation and other beneficial uses equal to or better than the conditions specified by the state agencies having control over the subject water (Council File 76940).

The City Council also endorsed the concept of a water reclamation program for the City (Resolution adopted 16 April 1969, Council File 143-207).

State funding to assist the City of Los Angeles to meet these water standards is provided through the Clean Water Grant Program of the California State Water Resources Control Board (SWRCB). Funds are obtained through the Clean Water Bond Laws of 1970 and 1974 (Water Code, Division 7, Chapters 13 and 14), and are disseminated to supplement Federal funds.

The Facilities Plan and the Environmental Impact Statement combine to assist decisionmakers in their goal of providing adequate wastewater treatment with minimum negative effects on the Los Angeles region environment. During the planning and environmental assessment process, comments on the environmental characteristics, impact causes, and potential impacts have, through feedback to the facility planning engineers, resulted in refinements and modifications to the Facilities Plan with resulting revisions in the Draft EIS. Final development of mitigative measures designed to reduce the severity of potential negative impacts attributable to the implementation of the Facilities Plan has taken into consideration the potential negative effects of the mitigative measures themselves. Decisionmakers are provided with this summarized analysis so that their discretionary actions can reflect a full understanding of potential impacts.

Throughout the EIS process, extensive review of the document under development is designed to insure that the information is comprehensive and factual. The close coordination among agencies included the development of an Issue Paper by the Environmental Protection Agency and a thorough review of preliminary material with extensive comments by EPA and SWRCB professionals involved in water quality and wastewater systems management. This review process provided an internal mechanism whereby the areas needing additional emphasis were identified, including detailed analysis of the marine environment, the publishing of land-use data not previously available, and development of computer simulations for predicting changes in air and water quality that could be attributed to the improvement in the availability and quality of wastewater treatment.

Public input to the EIS process was actively pursued at the commencement of the study effort and will be further incorporated into the Draft EIS. During the months of July and August, 1975, a series of public participation meetings were held to inform the community of the purpose of the Facilities Plan and the EIS. As part of the Draft EIS review process additional public meetings and hearings will provide a forum for public interaction both to inform Los Angeles citizens and to improve the explanatory aspects of the Environmental Impact Statement prior to preparation of the Final EIS.

B. brief description of existing facilities

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B. BRIEF DESCRIPTION OF EXISTING FACILITIES

The Los Angeles wastewater treatment system has developed over a period of nine decades with the City's major emphasis, until recent years, on the establishment of one main coastal plant, Hyperion. Pipe conduits or sewers of various sizes and classifications transmit wastewater from the place where it is generated and deliver it to the coastal plant for treatment. The Hyperion Treatment Plant, located on a 144-acre site adjacent to Santa Monica Bay, southwest of the Los Angeles International Airport, receives sewage from four major interceptor sewer systems.

The major construction activities that have occurred since the construction of the City's first outfall sewer to the ocean in 1907, the Central Outfall Sewer (COS), can be broken into two basic periods separated by America's involvement in World War II. Figure I-3 identifies the major construction activity that occurred prior to 1941. Between the years 1924 and 1930 the North Outfall Sewer (NOS) was constructed

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The Hyperion Treatment Plant is in its ninth decade of service to the City of Los Angeles.

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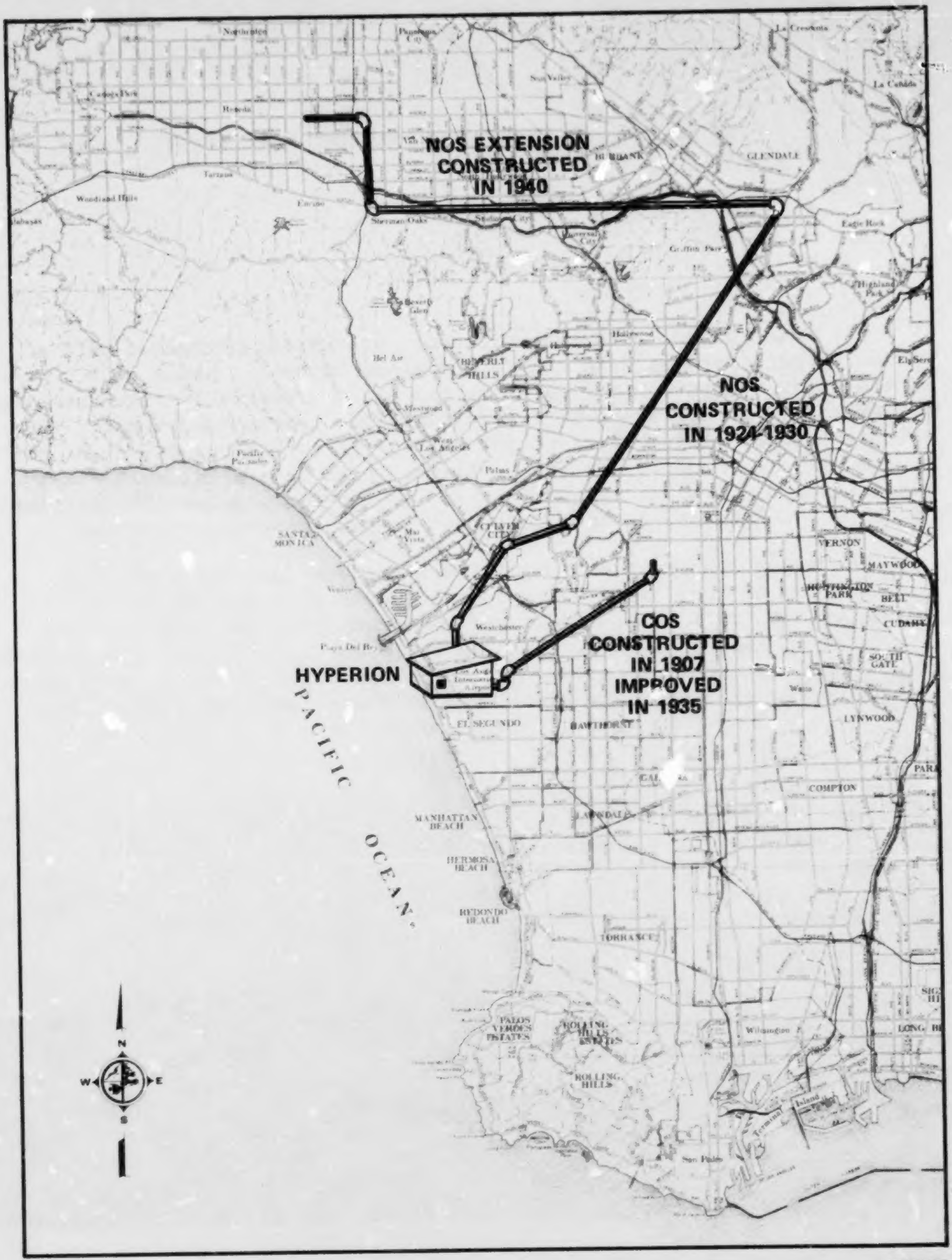
NOS EXTENSION
CONSTRUCTED
IN 1940
NOS
CONSTRUCTED
IN 1924-1930
COS
CONSTRUCTED
IN 1907
IMPROVED
IN 1935
HYPERION
PACIFIC OCEAN
BURBANK
GLENDALE
Sherman Oaks
Bel Air
BEVERLY HILLS
SANTA MONICA
CULVER CITY
Westchester
Playa Del Rey
EL SEGUNDO
HAWTHORNE
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
SOUTH GATE
LYNWOOD
COMPTON
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
Wilmington
San Pedro
Terminal Island
N
S
E
W

19BP-52

Figure I-3. Pre-World War II construction activities in the Hyperion system.

along the old Los Angeles riverbed (that discharged through Ballona Creek prior to 1825), up through the Los Angeles Narrows and into the North Hollywood area of the San Fernando Valley. The COS was improved in 1935 and the NOS was extended in 1940 to Van Nuys in the San Fernando Valley.

Post-1941 system expansion is shown in Figure I-4. The 1-mile ocean outfall was placed in operation in 1949. By 1951, the NOS had been extended into the Woodland Hills area on the western end of the Valley. The NOS proved inadequate to handle sewage flows, so between the years 1953 and 1966, a relief sewer and a tunnel, the La Cienega-San Fernando Valley Relief Sewer (LCSFVRS), were constructed to form a shortcut from the North Outfall Sewer in the Valley to the North Outfall Sewer on the south side of the Santa Monica Mountains. Flows from NOS and the Valley Outfall Relief Sewer (VORS) in the Valley through this relief sewer, combined with NOS flows from the east and north, exceeded the capacity of the NOS system northeast of Hyperion. The North Central Outfall Sewer (NCOS) was constructed in 1958 to provide relief for the NOS above the intersection of the La Cienega-San Fernando Valley Relief Sewer (LCSFVRS) and the NOS.

The NCOS accepted all flow from the NOS to the east and north, and the old NOS was allocated all the flow from the LCSFVRS. Additions to the Hyperion system included the Coastal Interceptor Sewer (CIS), which was added in 1954-1956 with improvements in 1971, and the Additional Valley Outfall Relief Sewer (AVORS), constructed in 1971 to accommodate increasing Valley flows. Two new ocean outfalls, the 5-mile outfall in 1961 and the 7-mile sludge outfall in 1969, were constructed to meet Health Department requirements and to eliminate beach closures resulting from pollution. Thus the four major subsystems of Hyperion were created:

- Central Outfall Sewer (COS) serving the south central Los Angeles area and adjoining areas to the south and southwest of the downtown area, El Segundo, and portions of Culver City.

- North Central Outfall Sewer-North Outfall Sewer Interceptor System (NCOS-NOS) serving the southern portions of the cities of Burbank and Glendale, eastern portions of the San Fernando Valley, sections of eastern, central, and south central Los Angeles, and portions of Culver City.

- North Outfall Sewer-La Cienega, San Fernando Valley Relief Sewer Interceptor System (NOS-LCSFVRS) serving the western portions of the City of Los Angeles, Beverly Hills, Hollywood, the central, northeastern, and western areas of the San Fernando Valley, and the Ballona Creek Valley, and Playa del Rey.

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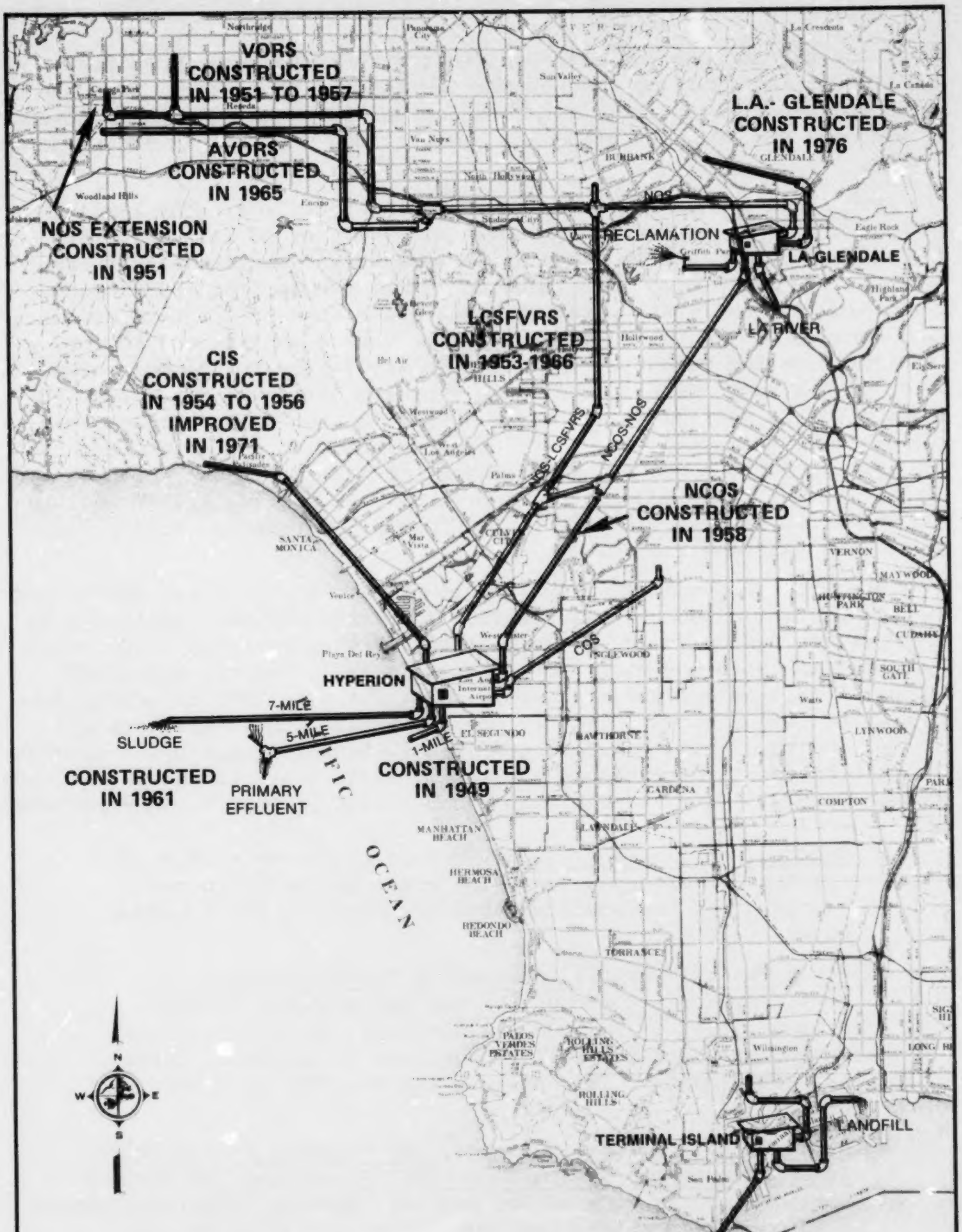

VORS
CONSTRUCTED
IN 1951 TO 1957
AVORS
CONSTRUCTED
IN 1965
NOS EXTENSION
CONSTRUCTED
IN 1951
L.A.- GLENDALE
CONSTRUCTED
IN 1976
NOS
RECLAMATION
LA-GLENDALE
LA RIVER
LCSFVRS
CONSTRUCTED
IN 1953-1966
CIS
CONSTRUCTED
IN 1954 TO 1956
IMPROVED
IN 1971
NOS-LCSFVRS
NCOS-NOS
NCOS
CONSTRUCTED
IN 1958
COS
HYPERION
7-MILE
5-MILE
1-MILE
SLUDGE
CONSTRUCTED
IN 1961
PRIMARY
EFFLUENT
CONSTRUCTED
IN 1949
PACIFIC
OCEAN
TERMINAL ISLAND
LANDFILL
SANTA MONICA
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
N
S
E
W

198P-53

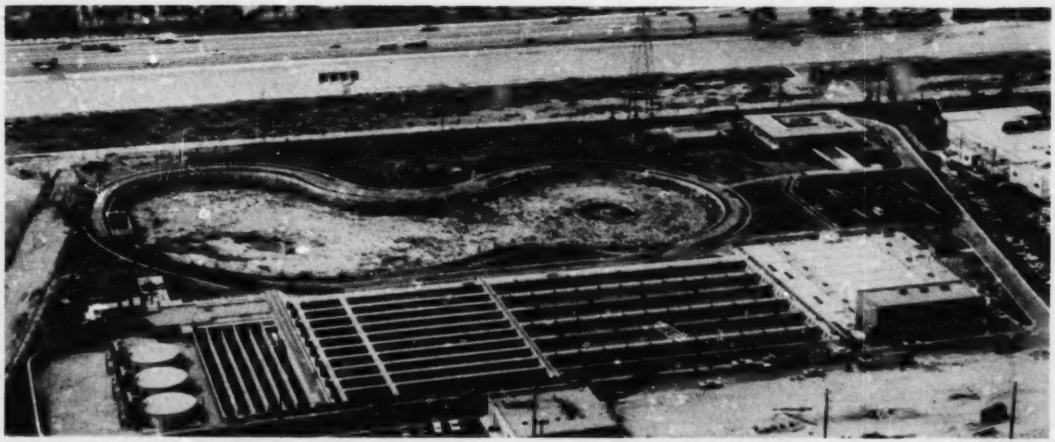
Figure I-4. Post-World War II relief sewers and facilities constructed in the Hyperion System.

- Coastal Interceptor Sewer System (CIS) serving the coastal area of the City of Los Angeles, Pacific Palisades, Venice, and Mar Vista, the City of Santa Monica, and adjacent areas of the County of Los Angeles.

The need for additional treatment capacity and the potential cost-effective reclamation and reuse of wastewater combined with the age of portions of the existing NCOS-NOS system led to the development of the Los Angeles-Glendale Water Reclamation Plant (LAGWRP) in the Los Angeles Narrows. This facility, operational in 1976, places treatment nearer the source of sewage and provides reclaimed water for irrigation and industry in an area where such reclaimed water can be economically marketed. The tertiary-treated effluent from this inland plant will be used for irrigation, industry, and recreation or discharged to the Los Angeles River. Sludge from LAGWRP is transported to the Hyperion Treatment Plant via the North Central Outfall Sewer-North Outfall Sewer Interceptor System (NCOS-NOS).

The Wilmington and San Pedro areas of the City are served by a separate "coastal" treatment plant located on Terminal Island in the Los Angeles Harbor. The 14-acre Terminal Island Treatment Plant (TITP) treats sewage for an area that is 20 miles south of downtown Los Angeles, and geographically isolated from the remainder of the City.

A schematic representation of the existing system including both the Hyperion and Terminal Island systems is given in Figure I-5. The four major interceptor systems are specified and the general system facilities locations are identified. The Los Angeles-Glendale plant is the only sewage treatment/water reclamation plant currently within the City's waste treatment system. It will be fully operational in 1977, and is treated in the EIS as an existing facility operating at a capacity of 20 mgd.



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The Los Angeles-Glendale Water Reclamation Plant began serving the southeast San Fernando Valley area in 1976.

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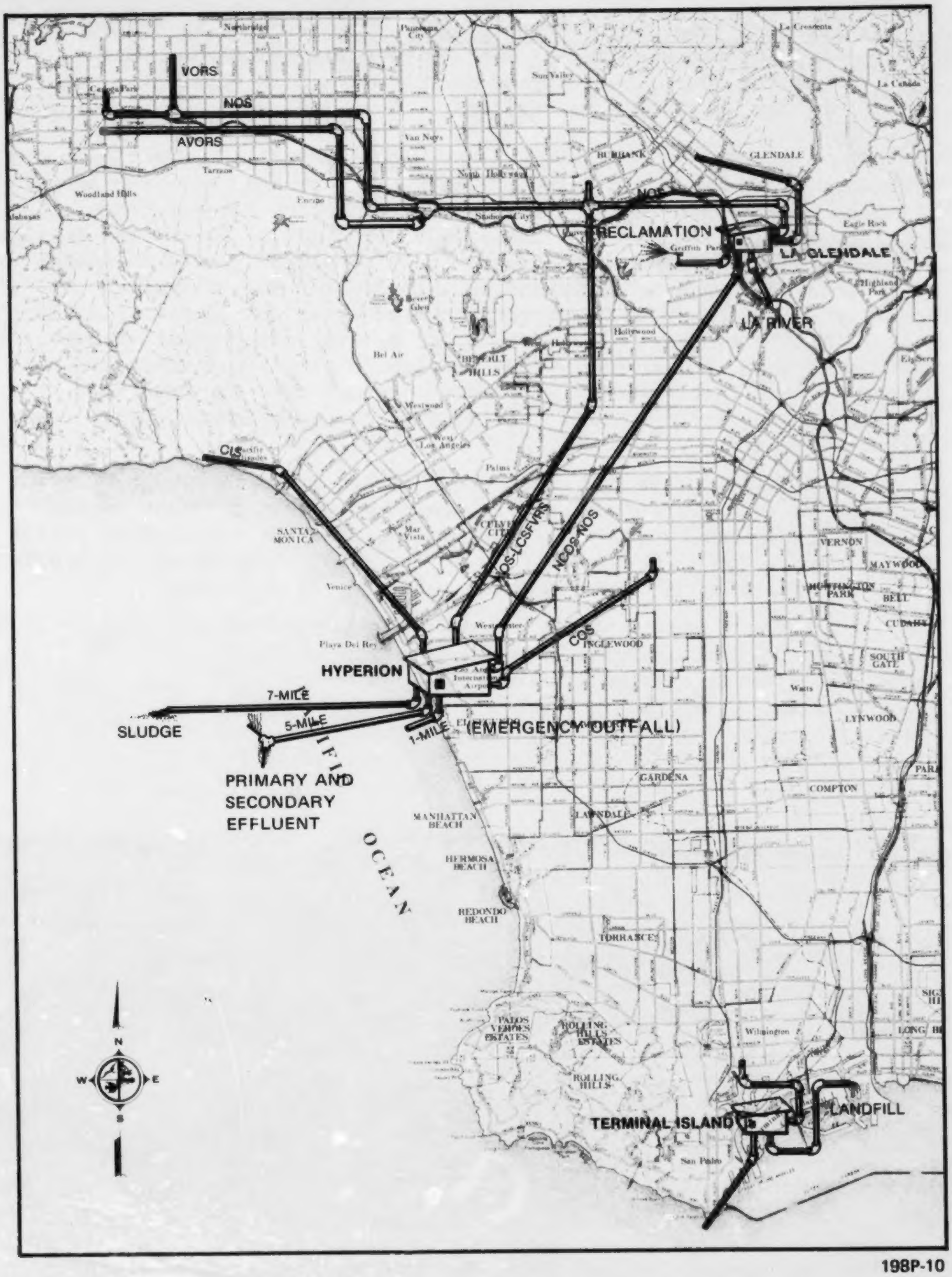
VORS
NOS
AVORS
Northridge
Panorama City
Sun Valley
La Crescenta
La Canada
Canoga Park
Van Nuys
Tarzana
Woodland Hills
North Hollywood
Encino
Sherman Oaks
Studio City
BURBANK
GLENDALE
NOS
RECLAMATION
Griffith Park
Eagle Rock
LA GLENDALE
Highland Park
LA RIVER
Beverly Glen
Bel Air
Hollywood
BEVERLY HILLS
Westwood
West Los Angeles
CIS
Pacific Palisades
Palms
SANTA MONICA
Mar Vista
CULVER CITY
NOS-LCSFVRS
NCOS-NOS
Venice
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
Playa Del Rey
Westchester
COS
INGLEWOOD
SOUTH GATE
HYPERION
Los Angeles International Airport
Watts
7-MILE
5-MILE
1-MILE
SLUDGE
(EMERGENCY OUTFALL)
LYNWOOD
PRIMARY AND SECONDARY EFFLUENT
GARDENA
COMPTON
MANHATTAN BEACH
LAWNDALE
OCEAN
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
Wilmington
LONG BEACH
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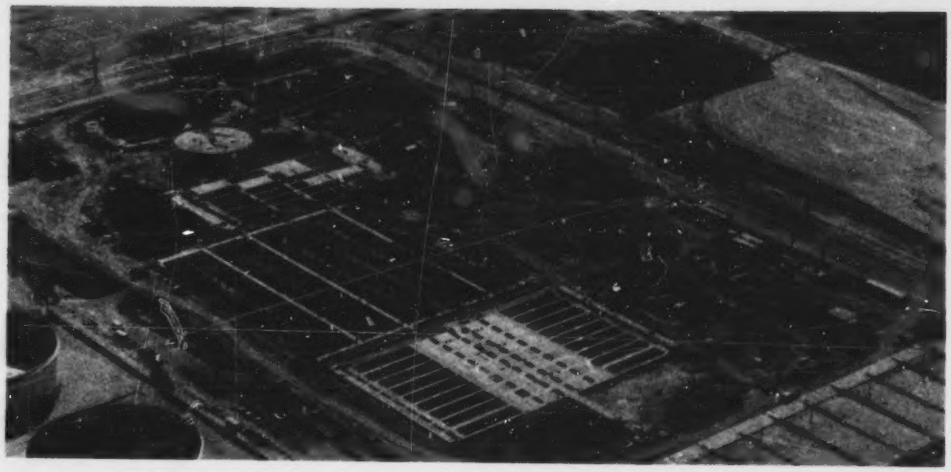
ROLLING HILLS
TERMINAL ISLAND
LANDFILL
San Pedro

198P-10

Figure I-5. Schematic representation of the existing Los Angeles City wastewater system.



198P—9

The Terminal Island Treatment Plant serving the Harbor area is currently undergoing renovation and upgrading to secondary treatment levels.

Also in the tributary area of HTP, but not owned by the City of Los Angeles, is the Burbank Water Reclamation Plant. This plant is owned and operated at an average rate of 9 mgd by the City of Burbank. Sludge is conveyed to the City of Los Angeles system, and removed at HTP. Reclaimed water is used for cooling in Burbank's adjacent power plant.

C. brief problem description

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C. BRIEF PROBLEM DESCRIPTION

The present collection and treatment system for the City of Los Angeles and contract cities requires several improvements to meet federal and state water quality requirements. Each of the main deficiencies is noted on Figure I-6.

1. SECONDARY TREATMENT

Extensive construction is needed at Hyperion to upgrade the present plant from full primary treatment with only partial (about one-quarter of the influent flow) secondary treatment to full secondary treatment. The wastewater discharges at Hyperion and Terminal Island are both to be upgraded to full secondary treatment level in order to comply with federal requirements. The EIS emphasizes project alternatives relating to the Hyperion system. The Terminal Island facilities have been funded and are treated in a separate EIS.

2. SLUDGE DISPOSAL

The present policy of pumping sludge through the Hyperion 7-mile outfall for ocean discharge is to cease by federal law. Determination of the ultimate disposal of this sludge is complicated by numerous factors. One is the uncertain availability of sanitary landfills capable of legally accepting liquid waste. Another is air quality regulations which effectively discourage incineration of dewatered sludge. These difficulties are common to the City of Los Angeles and neighboring sludge-generating treatment facilities. The Basinwide Wastewater Solids Management Program will seek a long-term solution to the sludge disposal problem. The Facilities Plan and EIS focus on the marine impacts of discontinuing sludge discharge to the ocean as opposed to present practices.

3. INFLOW AND INFILTRATION

With sewage flows a critical determinant in the designing of treatment plant facilities, any introduction of extraneous water flows will decrease the efficiency of treatment processes and could severely tax

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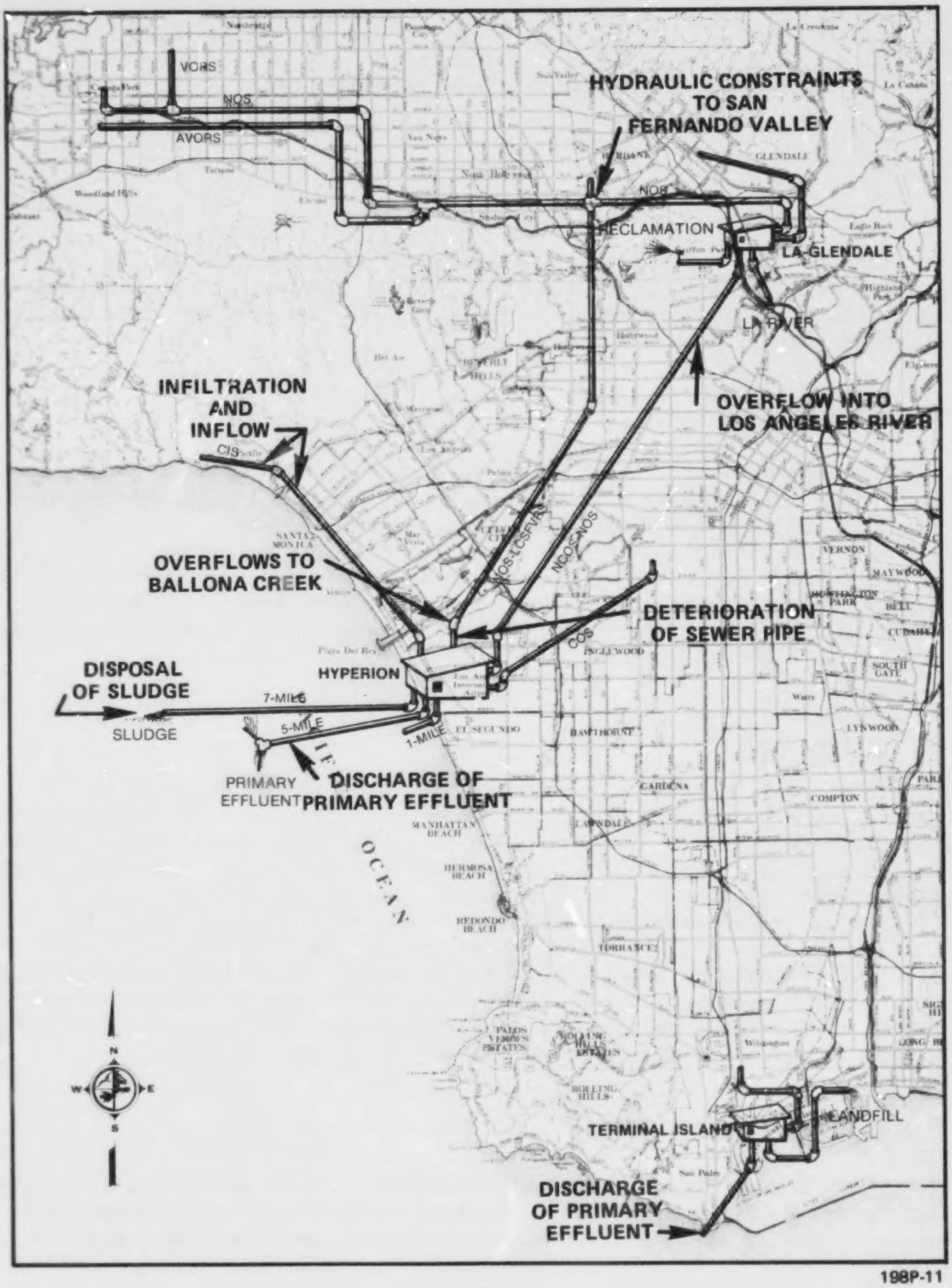
VORS
NOS
AVORS
HYDRAULIC CONSTRAINTS TO SAN FERNANDO VALLEY
NOS
RECLAMATION
LA-GLENDALE
LA RIVER
OVERFLOW INTO LOS ANGELES RIVER
INFILTRATION AND INFLOW
CIS
OVERFLOWS TO BALLONA CREEK
NOS-LCSFVIS
NCOS-NOS
DETERIORATION OF SEWER PIPE
COS
HYPERION
DISPOSAL OF SLUDGE
7-MILE
SLUDGE
5-MILE
1-MILE
PRIMARY EFFLUENT
DISCHARGE OF PRIMARY EFFLUENT
OCEAN
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TERMINAL ISLAND
LANDFILL
DISCHARGE OF PRIMARY EFFLUENT
GLENDALE
BURBANK
VERNON
INGLEWOOD
EL SEGUNDO
HAWTHORNE
GARDENA
COMPTON
LYNWOOD
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
SANTA MONICA
PALOS VERDES ESTATES
ROLLING HILLS
Wilmington
San Pedro

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Figure I-6. Deficiencies in the present City of Los Angeles wastewater treatment system.

plant capacity. Two types of unnecessary flows are termed inflow and infiltration (I/I). Inflow is storm flow that directly enters the sewer system through leaking manhole covers and illegal drain connections that connect surface water runoff, such as from roofs or driveways, directly to the sewer system instead of the storm drain system. Infiltration is ground water that enters the sewage lines through cracked or deteriorated pipes or pipe joints. At present, both infiltration and inflow occur in the City's sewer system although no particular portion of the system has been identified as a problem area except those sections, notably along the Coastal Interceptor Sewer (CIS), subject to salt water intrusion. The CIS parallels the coast and is shown on Figure I-6. The City's 1977-82 Five Year Capital Improvement Program calls for further study of I/I problems and no specific remedial actions have been included in the Facilities Plan or EIS.

4. HYDRAULIC CONSTRAINTS AND SEWER OVERFLOWS

The major deficiencies that exist in the NOS-LCSVRS Interceptor Sewer System are identified in Figure I-6. The North Outfall Sewer (NOS) was extended to the San Fernando Valley in the 1930s and early 1940s. Rapid development in the Valley required relief for NOS in the early 1950s so the Valley Outfall Relief Sewer (VORS) was constructed north of NOS. By the mid-1960s, considerable additional capacity was added with the completion of the Additional Valley Outfall Relief Sewer (AVORS), south of NOS. Residential, commercial, and some industrial growth in the San Fernando Valley has continued to the extent that flows are exceeding design capacity downstream of the Sepulveda Flood Control Basin at the intersection of the San Diego and Ventura Freeways. The three potential alternative methods discussed in this EIS of providing relief are through construction of a relief sewer to conduct additional flows to Hyperion for treatment (AVORS addition), through construction of inland treatment facilities (primarily the Sepulveda Plant), or through curtailment of flow.

A second hydraulic restriction exists further down the NOS-LCSFVRS in Culver City, where normal flow combined with infiltration and inflow during storm conditions exceeds the North Outfall Sewer's capacity and chlorinated raw sewage is discharged into Ballona Creek to flow into Santa Monica Bay adjacent to Playa del Rey. Overflow discharge occurs about once per year but is erratic. The maximum discharge ever measured was 37.0 million gallons in a single storm (see Table I-1). The overflow problem can be resolved by reducing the flow through correction of infiltration and inflow problems, through provision of inland treatment, or through improvement of the sewage system so that it can accept the increased flow and transmit the flow to Hyperion for treatment. These possibilities are included in different alternative facility plans discussed in this EIS.

Relatively lesser hydraulic problems exist in two other locations. The NCOS-NOS Interceptor Sewer System crosses the Los Angeles River immediately northwest of the Pasadena Freeway. The sewer exhibits excessive leakage at this point and will require repair and relocation of NOS under the Los Angeles River. The second lesser problem exists as the NOS enters Hyperion Treatment Plant. Deterioration of mid-1920's concrete sewer pipe will require eventual replacement of the sewer. These projects are recommended in the Five-Year Capital Improvement Program and can be implemented independently of any other elements of the major alternative facility plans.

Table I-1. NOS-LCSFVRS overflow into Ballona Creek at Jackson Avenue bypass structure (Bureau of Engineering, 1975).

DATE	PEAK FLOW (mgd)	FLOW DURATION (hours)	TOTAL FLOW (mg)
22 Nov 65	16.0	1.7	--[3]
29 Dec 65	102.0	5.0	16.3
7 Nov 66	6.0	2.5	--[3]
21 Nov 67	8.0	1.5	--[3]
22 Nov 67	--[1]	3.2	--[3]
25 Jan 69	--[2]	--[2]	--[3]
23 Feb 69	14.0	4.5	1.9
29 Nov 70	126.0	7.0	21.1
24 Dec 71	30.0	1.7	--[3]
7 Jan 74	116.0	15.4	37.0

[1] No record due to power failure; 40 mgd estimated visually.

[2] No record; apparently peak flow was very small.

[3] Insufficient data to compute.

D. brief description of the alternative projects

D. BRIEF DESCRIPTION OF THE ALTERNATIVE PROJECTS

1. GENERAL ALTERNATIVES CONSIDERED

Alternatives presented in the Facilities Plan are designed to eliminate deficiencies and meet the following criteria:

- Discontinuation of sludge disposal to the ocean. (This is a pre-Facilities Plan project addressed by a separate project report.)
- Provision of full secondary treatment of effluents discharged to receiving waters.
- Provision of capacity adequate to serve the expected population projected for the year 2000.
- Relief of sewage overflow problems.

The Facilities Plan discusses seventeen separate alternatives in categories identified by letter symbols (A, B, etc.). In addition, two alternatives ("X Alternatives") not described in the Facilities Plan are addressed in the EIS.

The nineteen alternatives, including three "no project" possibilities, which received initial consideration are discussed in Chapter VII. In brief, the following generalizations characterize the alternatives in each series:

• A series.	"No Project" alternative with subalternatives providing hydraulic relief to the San Fernando Valley.
• B series.	Coastal/inland alternatives, with treatment capacities varied among Hyperion and two potential inland sites.
• C series.	Coastal-only alternative, with subalternatives providing hydraulic relief to the San Fernando Valley.
• D series.	Zero discharge alternatives - no discharge to receiving waters.
• E series.	Maximum reclamation alternative.
• F series.	Combination of Los Angeles City System with that of County Sanitation Districts.

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- G series. Treatment of storm runoff (not a wastewater-related alternative, not in scope of present plan).
- H series. Improved management, operational, and maintenance procedures.
- X series. Additional alternatives, not addressed directly in the Facilities Plan, that would meet legislative mandates but not necessarily provide significant hydraulic relief to San Fernando Valley.

Excluding Alternative G which is a regional solution and Alternative H which will be incorporated into any other alternative, the remaining 17 projects fall into five basic categories:

- No project alternatives which all fail to meet state and federal requirements for sludge disposal and secondary treatment (A series).
- Inland/Coastal treatment projects which include additional waste treatment facilities at inland locations as well as coastal treatment through modernization at Hyperion (B and F series).
- Coastal treatment projects which include hydraulic relief to the San Fernando Valley through the interceptors or some other means excluding inland treatment (C and D series).
- Treatment projects which do not include hydraulic relief to the San Fernando Valley but do meet ocean discharge requirements (CX only). (This is not a viable alternative but is proposed for implementation to form a basis for analyzing secondary air quality impacts resulting from population increases in the San Fernando Valley.)
- Full reclamation projects which include a new water reclamation plant in the La Cienega area (E2 and EX).

System improvements common to all alternatives except for the A series, the No Project Alternatives, are identified in Figure I-7. Some existing problems such as minimization of infiltration and inflow to the Coastal Interceptor Sewer, and repair of exfiltration to the L.A. River are discussed briefly in the Facilities Plan as "additional projects of significance" which are recommended in the 1977-82 Five-Year Capital Improvement Program. These projects are independent of the major alternatives which receive detailed examination in the Facilities Plan, and could be implemented with or without other project elements. A comparison of Figure I-6 with Figure I-7 shows that all major problems except for hydraulic relief are resolved by each of the alternatives.

2. ALTERNATIVE RECEIVING DETAILED CONSIDERATION

An initial screening of alternatives is presented in the Facilities Plan and summarized in Chapter VII of this EIS. On the basis of cost

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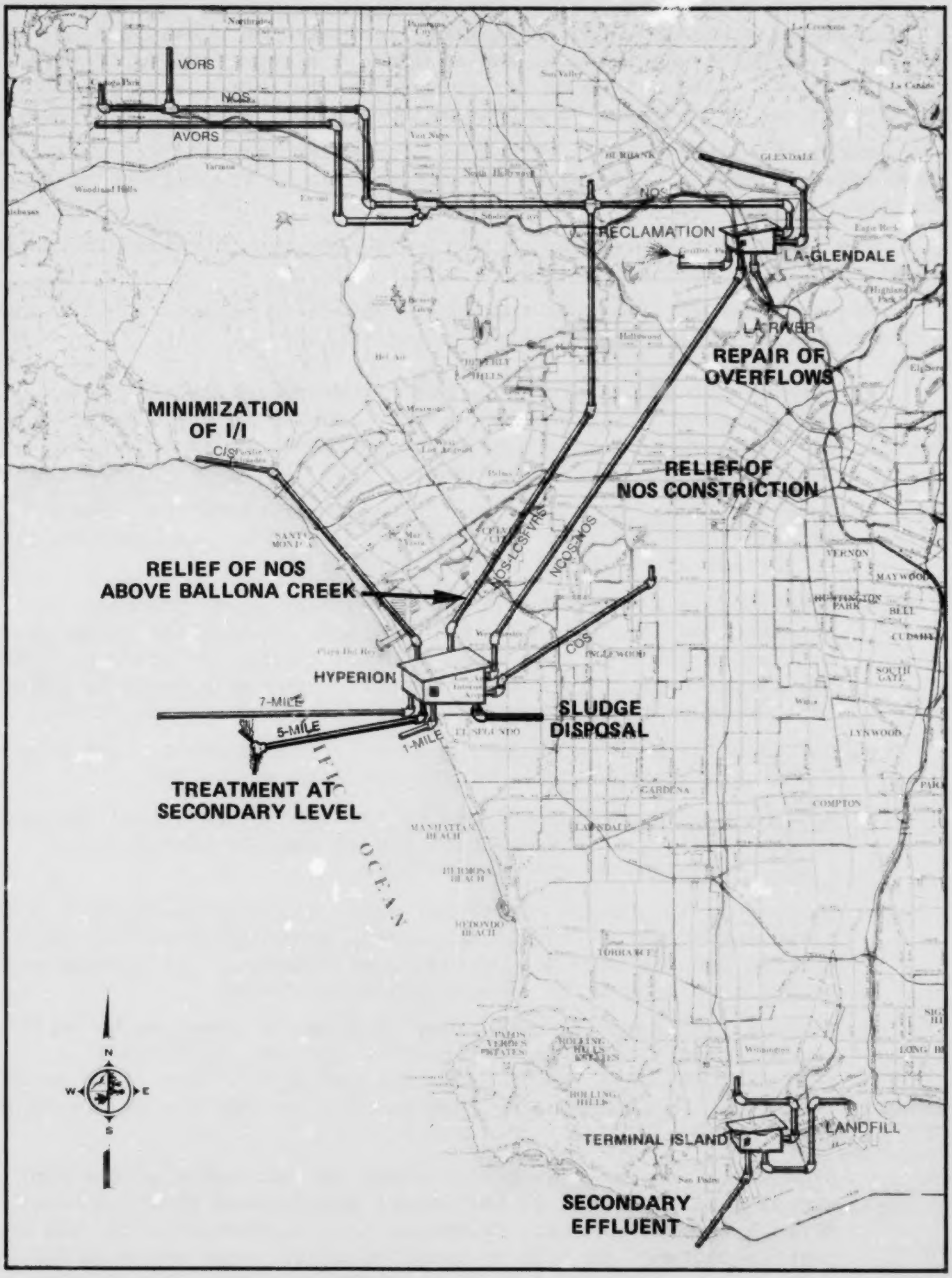
VORS
NOS
AVORS
NOS
RECLAMATION
LA-GLENDALE
LA RIVER
REPAIR OF OVERFLOWS
MINIMIZATION OF I/I
CIS
RELIEF OF NOS CONSTRICTION
NOS-LCS-VRS
NCOS-NOS
RELIEF OF NOS ABOVE BALLONA CREEK
COS
HYPERION
7-MILE
5-MILE
1-MILE
SLUDGE DISPOSAL
TREATMENT AT SECONDARY LEVEL
OCEAN
TERMINAL ISLAND
LANDFILL
SECONDARY EFFLUENT
N
W
E
S
Northridge
Sun Valley
La Crescenta
La Canada
Van Nuys
BURBANK
GLENDALE
North Hollywood
Woodland Hills
Tarzana
Encino
Eagle Rock
Highland Park
Hollywood
Bel Air
BEVERLY HILLS
Westwood
West Los Angeles
SANTA MONICA
CULVER CITY
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
SOUTH GATE
INGLEWOOD
Watts
EL SEGUNDO
LYNWOOD
GARDENA
COMPTON
LAWNDALE
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
Wilmington
San Pedro

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Figure I-7. Specific projects common to project alternatives presented in the Facilities Plan.

effectiveness screening, the Facilities Plan selected a single B alternative, a single E alternative, and a single C alternative for further consideration. Alternative A1 is included for further analysis because of the federal requirement to consider "No Project" as an alternative.

The extra alternatives, CX and EX, considered for the EIS were given cost-effectiveness consideration and Alternative EX was eliminated from further consideration.

The final list of alternatives selected for consideration in the EIS is A1, B4C, C3, CX, and E2.

Major structural features that are combined in various ways to comprise the alternatives are explained briefly below:

- Hyperion or HTP refers to plants of various sizes that would provide secondary treatment, and be located at the site of the existing Hyperion Treatment Plant on the coast south of the Los Angeles International Airport.
- Interim Sludge Processing and Disposal refers to the proposed program for dewatering and landfilling sludge. The processing facilities are to be located at Hyperion.
- Sepulveda is a 40-mgd wastewater treatment plant proposed for construction in the San Fernando Valley. This plant would be located in the Sepulveda Flood Control Basin, and would provide tertiary treatment of the wastewater. Sepulveda would be expanded in increments to an ultimate capacity of approximately 85 mgd.
- LA-Glendale is an existing 20-mgd water reclamation plant near the southeasternmost part of the San Fernando Valley.
- Modular Expansion of Sepulveda or LA-Glendale refers to increases in the capacity of these facilities in various multiples of 5 mgd, depending on the alternative.
- La Cienega is a large additional water reclamation plant currently being investigated for the La Cienega area near where the NOS-LCSFVRS and the NCOS-NOS systems come together. La Cienega would be built at a capacity of approximately 75 mgd.
- EVIS is the proposed East Valley Interceptor Sewer to be built in two units. All alternatives that include Sepulveda also include EVIS, which would intercept and divert flows from areas in the San Fernando Valley that would otherwise not be tributary to Sepulveda.
- AVORS is a proposed new relief sewer (an extension of the Additional Valley Outfall Relief Sewer) which would flow southward through the Santa Monica Mountains (tunnel portion), and subsequently eastward to join an existing interceptor sewer (NCOS) tributary to the Hyperion Treatment Plant. This sewer would carry flows generated in the western end of the San Fernando Valley.

- Woodman Avenue Relief Sewer would be built only with AVORS to increase the service area tributary to the additional tunnel capacity.
- Griffith Park Reclaimed Water Delivery System is an irrigation project for providing tertiary treated water from LA-Glendale to Griffith Park. This could be constructed with or without any other project elements.
- Sepulveda Dam Recreation Area Reclaimed Water Delivery System would be built if Sepulveda were built and would make tertiary treated water available for irrigation.

Table I-2 shows the construction and operation dates proposed for structural elements of each of the five alternatives receiving final consideration.

a. No Project (A1). The only changes to existing conditions that would result from the No Project Alternative are modernization of Hyperion treatment facilities and an increase in secondary capacity of Hyperion to provide secondary treatment up to 200 mgd. This would involve removal and replacement of existing secondary facilities with a pure oxygen secondary system. No new construction would be undertaken at any other site, and no change would be implemented in sludge disposal procedures. (The Interim Sludge Processing and Disposal Program has not been included in this No Project discussion but can be implemented with or without any other project elements.) Only minor repairs and maintenance would be made as necessary to maintain existing systems.

b. Inland-Coastal Split of Treatment Capacity (B4C). The City's preferred alternative for providing full secondary treatment is Alternative B4C. Major elements of this alternative include provision of 307 mgd secondary treatment at Hyperion, including replacement of existing secondary, with a pure oxygen secondary, and an initial 40 mgd tertiary treatment at Sepulveda, followed by 30 mgd and 15 mgd additions to Sepulveda and a 10 mgd addition to the existing 20 mgd LA-Glendale Water Reclamation Plant. Sludge removal and disposal for all three treatment facilities would be provided at Hyperion. In addition to the three major treatment facilities recommended under this alternative, the East Valley Interceptor Sewer would be constructed in two units to increase the service area tributary to the Sepulveda Water Reclamation Plant. Reclaimed water made available by the Sepulveda and L.A.-Glendale Plants would be distributed for irrigation purposes through the two proposed systems: Sepulveda Dam Recreation Area Reclaimed Water Delivery System and the Griffith Park Reclaimed Water Delivery System.

Table I-2. Summary of construction and O&M dates for elements of major alternatives.

PROJECT	NO PROJECT		B4C		C3		CX		E2	
	CONSTR.	O&M	CONSTR.	O&M	CONSTR.	O&M	CONSTR.	O&M	CONSTR.	O&M
HTP Secondary Conversion (307 mgd)	-	-	77-82	82-2000	-	-	-	-	78-82	82-2000
HTP Flexibility to Lower Capacity	-	-	-	-	-	-	-	-	1977	82-2000
HTP Secondary Conversion (397 mgd)	-	-	-	-	77-82	72-2000	-	-	-	-
HTP Secondary Conversion (387 mgd)	-	-	-	-	-	-	77-82	82-2000	-	-
HTP Modernization (+ up to 200 mgd secondary)	77-82	82-2000	-	-	-	-	-	-	-	-
HTP Interim Sludge Processing and Disposal	-	-	1978-80	80-97	1978-80	80-97	1978-80	80-97	1978-80	80-97
Sepulveda Plant (40 mgd)	-	-	77-80	79-2000	-	-	-	-	77-80	79-2000
Sepulveda Plant (30 mgd Addition)	-	-	79-80	81-2000	-	-	-	-	79-80	81-2000
Sepulveda Plant (15 mgd Addition)	-	-	92-93	94-2000	-	-	-	-	92-93	94-2000
La Cienega Water Reclamation Plant (75 mgd)	-	-	-	-	-	-	-	-	82-85	86-2000
East Valley Interceptor Sewer										
EVIS I	-	-	78-79	80-2000	-	-	-	-	78-79	80-2000
EVIS II	-	-	82-83	84-2000	-	-	-	-	82-83	84-2000
Los Angeles-Glendale (10 mgd Addition)	-	-	88-89	89-2000	-	-	88-89	89-2000	88-89	89-2000
AVORS (85 cfs)	-	-	-	-	77-79	80-2000	-	-	-	-
Griffith Park Reclaimed Water Delivery System (9 mgd)	-	-	77-78	79-2000	77-78	79-2000	77-78	79-2000	77-78	79-2000
Sepulveda Dam Recreation Area Reclaimed Water Delivery System (9 mgd)	-	-	1980	81-2000	-	-	-	-	1980	81-2000
Woodman Ave. Relief Sewer (54 cfs)	-	-	-	-	82-83	84-2000	-	-	-	-
Total Capacity (Secondary or Better)		220		422		417		417		422

c. Coastal Capacity with Relief Sewer for the San Fernando Valley (C3). Under Alternative C3, 397 mgd of secondary treatment would be provided at the Hyperion Treatment Plant. The existing secondary system would be replaced with a pure oxygen secondary system. The only other treatment facility would be the existing 20 mgd LA-Glendale Plant. The Additional Valley Outfall Relief Sewer, or AVORS, would be constructed to a capacity of 85 cfs to transport sewage wastes from the San Fernando Valley to the Hyperion Treatment Plant. The Woodman Avenue Relief Sewer, along the same alignment as the proposed EVIS Unit II, would be necessary to enlarge the service area which would be tributary to the AVORS addition. Alternative C3 also includes interim sludge processing at Hyperion Treatment Plant and operation of the Griffith Park Reclaimed Water Delivery System.

d. Coastal Capacity without Hydraulic Relief for the San Fernando Valley (CX). Alternative CX would fulfill federal and state requirements for providing full secondary treatment of effluents discharged to receiving waters and for terminating sludge disposal to the ocean. However, the alternative does not provide for hydraulic relief of the San Fernando Valley adequate to meet the needs generated by anticipated population growth after the 1980s, and therefore, does not meet the City of Los Angeles' criteria for planning. Alternative CX is discussed in this EIS to determine the impact on air quality of population increases in the San Fernando Valley.

Alternative CX would provide most of the additional secondary treatment capacity needed in the project area at the Hyperion Treatment Plant. Also, a 10 mgd addition would be built on to the existing 20 mgd LA-Glendale Water Reclamation Plant. This would provide limited hydraulic relief to the San Fernando Valley by increasing upstream treatment capacity. No other projects to relieve hydraulic constraints in the San Fernando Valley are proposed under this alternative. Neither the Sepulveda Water Reclamation Plant nor the AVORS would be constructed. The Griffith Park Reclaimed Water Delivery System is proposed as part of this project but could be eliminated without affecting other project elements. Alternative CX is evaluated in order to assess the secondary impacts on air quality of growth versus no growth in the San Fernando Valley.

e. Inland-Coastal Split with Maximum Potential for Reclamation (E2). Alternative E2 includes project elements that would allow a maximum amount of water reclamation. Project elements are similar to those proposed for Alternative B4C with the major exceptions that a 75 mgd La Cienega Water Reclamation Plant would be operational in 1986 and that the initial 307 mgd unit at Hyperion would be modified after 1986 to treat 232 mgd with 50 mgd receiving advanced treatment for reclamation. The remaining secondary system would be converted to fine-bubble aeration. Provisions for including this flexibility in the 307 mgd Hyperion Unit would be complete in 1977.

Proposals for constructing and adding to the Sepulveda Water Reclamation Plant and the Los Angeles-Glendale Water Reclamation Plant are the same as described for Alternative B4C. Other common project elements include the Interim Sludge Processing and Disposal Program, the East Valley Interceptor Sewer Units I and II, the Griffith Park Reclaimed Water Delivery System, and the Sepulveda Dam Recreation Area Reclaimed Water Delivery System. As with other alternatives, implementation of the Interim Sludge Program and operation of the Griffith Park Reclaimed Water Delivery System are independent of other project elements. This project involves an apparent delay in implementation of full secondary treatment and, therefore, is considered not viable.

3. COST ANALYSIS OF ALTERNATIVES

A full review of project costs is contained in Chapters VII and VIII. Table I-3 summarizes total costs of the main alternatives considered.

Estimated project costs are subject to change following review of the Draft Facilities Plan. Some of the design uncertainties potentially affecting cost estimates include questions regarding availability of land at the Hyperion site. The costs for Alternative C3 include the very high costs of placing a retaining wall behind the facility, apparently increasing the costs by $60 million. The question is whether in lieu of the retaining wall, it would be possible to place the additional facilities on other sites at

Table I-3. Costs (1975 dollars in millions) and present worths for alternatives receiving final consideration.

	A1 NO PROJECT	HYPERION/ SEPULVEDA B4C	HYPERION C3	RECLAMATION E2
Total Construction Cost	$ 122	$ 277	$ 347	$ 343
Total Operational Cost	235	453	403	511
Total Project Cost	357	730	750	854
Construction Present Worth	$ 97	$ 201	$ 274	$ 242
Operational Present Worth	105	190	169	208
Total Present Worth	202	391	443	450

Note: These are the costs presented in the preliminary drafts of the Facilities Plan. They are expected to change after the Draft Facilities Plan is published (simultaneous with the EIS) and undergoes review by concerned agencies.

Hyperion or in the adjacent industrial complexes. This issue is further discussed in the Facilities Plan.

The Facilities Plan notes that a 150 mgd secondary facility (or tertiary) could be constructed in an undeveloped parcel of Standard Oil land for approximately $54 million. However, this is not a viable possibility because the land is not available to the City of Los Angeles.

The proposed Sepulveda facility has already been designed. Because of NPDES changes in discharge criteria, design and revisions will possibly be needed to meet higher discharge requirements. The operational LA-Glendale facility also will have to meet these requirements.

All of the alternatives developed above include the removal and replacement of the existing secondary treatment facilities. These facilities are capable of treating flows in the neighborhood of 150 mgd, although they are presently operated at 100 mgd so as to attain a very high quality effluent (much higher than secondary requirements). Aside from the question of whether it is cost-effective to remove these facilities, there remains the issue of the impact on the marine environment of discontinuing, for a period of years, the secondary treatment. The SWRCB, acting on appeal from the City, determined from a cost-effective basis that the City should plan for removal of the existing secondary facilities on February 17, 1977. EPA has not yet reached a final determination on the environmental consequences.

LA-Glendale expansion to 30 mgd with Alternative C3 apparently was not pursued in the Facilities Plan.

The money earned by selling reclaimed water has not been included in the cost-benefit analysis for Alternative E2. This would tend to lower the costs of the reclamation alternative. Appendix F to the Facilities Plan compares potential costs and impacts of producing equal quantities of reclaimed water with Alternatives B4C and E2. In the reclamation analysis, Alternative B4C is augmented to result in production of reclaimed water equal to that provided by Alternative E2. Table I-4 presents cost comparisons between Alternative E2 and augmented Alternative B4C. Results of the study presented in Appendix F to the Facilities Plan indicate that implementation of augmented Alternative B4C would result in increased requirements for dollars, energy, land, and revenue support as compared to the same level of water reclamation under alternative E2. When the total costs of providing full secondary treatment and reclamation are considered, augmented alternative B4C would be somewhat less expensive than E2 as shown in Table I-4.

Table I-4. Cost analysis of HTP and LCWRP sewage treatment plus water reclamation.

IDENTIFICATION OF SYSTEM	SYSTEM CAPITAL AND O&M COSTS, 1975 DOLLARS IN MILLIONS	
	ALTERNATIVE E2	ALTERNATIVE B4C
Sewage Treatment for Ocean Disposal		
Hyperion TP (1980)	$449 (307 mgd)[2]	$468 (307 mgd)
La Cienega WRP (1985)	$111 (75 mgd)	
Water Reclamation[1]		
System Alternative No. 1	$206	$221
System Alternative No. 2	276	301
System Alternative No. 3	245	271
System Alternative No. 4	315	351
System Alternative No. 5	269	326
System Alternative No. 6	339	402
Total—Range based on Water System Alternative	$766-$899	$689-$870

[1] SYSTEM ALTERNATIVE DESCRIPTION

	System Alternatives and Level of Use (mgd)					
	1	2	3	4	5	6
Standard Oil Refinery	8	8	8	8	8	8
SW Los Angeles Industries	30	30	52	52	52	52
West Coast Basin Barrier		35		35		35
Vernon Industries					20	20
Total Use	38	73	60	95	80	115

[2] Constructed with pure oxygen secondary system for 307 mgd with flexibility for conversion to 232 mgd with fine-bubble secondary system.

E. goals of this EIS

E. GOALS OF THIS EIS

The basic goals of this Environmental Impact Statement are:

- To present information to the public, concerned agencies, and public officials to assist in the decisionmaking process.
- To highlight the environmentally sensitive areas in the City of Los Angeles and its metropolitan region.
- To define the role that wastewater treatment alternatives play in changing the existing environment of these areas.
- To evaluate the potential for water reclamation and conservation.
- To evaluate and recommend a list of feasible alternatives ranked according to their environmental impacts, either positive or negative.
- To suggest mitigative measures that will allow maintenance of water quality and expansion to meet future needs without adversely affecting the social, biological, and physical environment of Los Angeles.

To meet these six basic goals, this Environmental Impact Statement (EIS) is prepared in compliance with the National Environmental Policy Act of 1969 and incorporates additional details required by the California Environmental Quality Act of 1970. The EIS is a disclosure document and an integral part of the decisionmaking process designed to ensure that environmental considerations are involved in developing and adopting the candidate Facilities Plan concept. The major environmental issues identified by the Environmental Protection Agency as required for consideration in the EIS are:

- Total System Capacity. What additional capacity should be provided for the system and what are the primary and secondary effects of providing this capacity?
- Location of System Capacity. Where should the additional capacity be located for cost-effective wastewater treatment with minimal environmental impacts?

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- Ocean Discharge. What changes will result in the nature of wastewater constituents entering the Pacific Ocean and what will be the effects of these changes?
- Reclamation. What are the values, feasibility, and environmental impacts of measures designed to conserve and utilize wastewater and its components through reclamation?

Additional details regarding each of the major issues are provided in the Environmental Protection Agency's Issue Paper.

1. TOTAL SYSTEM CAPACITY

Chapter VI discusses the existing system capacity and the required modifications necessary to bring wastewater discharges into conformity with state and federal guidelines. The EIS serves as the tool to investigate the effects of improved and/or increased capacity for wastewater treatment on growth and population shifts into and within the service area. The EIS also considers the indirect effects of providing expanded wastewater treatment facilities on other community services including education, health and safety, and transportation facilities. The availability of wastewater treatment can serve as a contributor to indirect impacts on critical elements of the environment such as air quality. The lack of public utilities can also serve as a constraint on development if the utilities are absolutely necessary. The EIS determines where the alternative projects lie on this continuum between inducing and constraining growth in the service area.

The evaluation of indirect effects considers the historical stimulants to growth and population shifts on a regional and local service area basis. This evaluation includes analysis of the role of employment opportunities, transportation facilities assessed evaluations, supplies of services such as water and sewer, and applicable social factors in determining population growth and shifts. Local, regional and state land use plans and population projections are analyzed to project where, how much, and in what form growth or population shifts are expected to occur over the 25-year period considered in the Facilities Plan. Each of the more viable alternatives developed in the Facilities Plan and presented in Chapter VII is analyzed to determine the indirect impact upon environmentally sensitive areas, especially air quality. Potential measures can be incorporated to mitigate or reduce the severity of the impacts upon the Los Angeles area. Estimated benefits and costs of these mitigative measures are included in Chapter X so that the City and other agencies capable of instituting the measures are aware of the probable net effects of their decisions.

2. LOCATION OF SYSTEM TREATMENT CAPACITY

The major issue here is whether or not a treatment facility should be constructed in the San Fernando Valley (Sepulveda flood control basin).

The proposed Sepulveda facility would treat an initial flow of 40 million gallons per day (mgd) increasing to an eventual ultimate capacity of 90 mgd. If the capacity is not provided at Sepulveda, the capacity would have to be added to the Hyperion facility in Playa del Rey, adjacent to Los Angeles International Airport. Adding the capacity to Hyperion would likely necessitate an additional sewer outfall line (AVORS tunnel) to the San Fernando Valley to transport the wastewater. The issues related to the Sepulveda site include: cost-effectiveness of the separate Sepulveda facility, the possible need for sludge disposal at the facility, its safety during floods and earthquakes, and the impact on groundwater of the discharge. Issues related to a Hyperion location for this capacity include land availability, the cost of a new outfall line (AVORS tunnel), or problems associated with holding tanks, and usurpation of land areas needed for potential reclamation facilities at Hyperion.

Because provision of either treatment facilities or an outfall line to the San Fernando Valley would allow population density to increase in the Valley at the expense of the City area south of the mountains, of concern in this issue are the secondary impacts, especially those on air quality.

3. OCEAN DISCHARGE

The City presently treats all of its wastewater to primary or secondary levels before discharge out a 5-mile pipe into Santa Monica Bay. However, Los Angeles also discharges to the ocean the solids removed in treatment (minus those converted to gases and water). These solids, called "sludge," are discharged out a 7-mile pipe. The EIS attempts to answer the following questions concerning ocean discharge.

What adverse impacts presently occurring in the ocean may be reasonably attributed to these wastewater discharges? What concentrations of pollutants still provide for protection of the marine environment? What amount of treatment or wastewater management (e.g., industrial pretreatment) reduces the pollutant concentrations adequately? An additional marine issue which may need resolution is whether a biological oxygen demand (BOD) concentration of higher than the 30 mg/l requirement could be tolerated in terms of marine impacts. Many agencies, including Los Angeles, have argued that the standard is too strict for marine discharges.

Presently, all domestic wastewater discharges across the nation are mandated by PL 92-500 to achieve as a minimum a secondary level of treatment. As presently defined in EPA regulations, secondary treatment achieves at least a removal to 30 mg/l for both BOD and total suspended solids (TSS). The discharge of any sludge is prohibited and Los Angeles has accepted grant conditions and permits requiring that the discharge terminate. On December 14, 1972, the City Council adopted a schedule to cease the sludge discharge by December 30, 1976. This has been revised by the NPDES permit to April 1, 1978. The City Council asked that the EPA further examine the consequences of continued dumping of sludge in the ocean and the impacts of sludge disposal on the land. Originally, the sludge removal project had been scheduled to proceed prior to completion of the EIS.

The impacts of the continued discharge of the sludge are described in the description of the existing marine environment in Chapter III. The impacts of disposal on the land are covered in Addendum #3.

Forty percent of the solids removed by wastewater treatment are converted to gases and water. The remaining 60 percent are subsequently discharged to the ocean through the 7-mile outfall. Since most of the removed solids are discharged as sludge, the current wastewater system does not achieve its potential net benefit for marine water quality. The conversion of solids to gases and water likely lessens the potential for the accumulation of a blanket of organic material on the ocean bottom. However, the problem constituents, metals and chlorinated hydrocarbons, are discharged in the same quantities with the present treatment system as would be the case with no treatment.

The significance of the issue is underscored by a conclusion of the University Task Force to Evaluate Water Quality Effects of Hyperion Sludge Discharge (May 1977):

> It is obvious that the environment around the 7-mile line is unhealthy for many, but not all, species. We do not recommend eating fish caught in the vicinity of the Hyperion outfalls, because of the accumulations of halogenated hydrocarbons.

4. RECLAMATION

The City presently reclaims a small portion of its wastewater at the LA-Glendale facility. A major issue discussed in the EIS is the potential for large-scale reclamation both at the Hyperion facility and at a proposed La Cienega facility. Of major importance in the facilities planning effort is the need to accommodate future reclamation opportunities by appropriate facility siting and by the adoption of treatment techniques which produce effluents amenable to reclamation.

The specific issues involved are as follows:

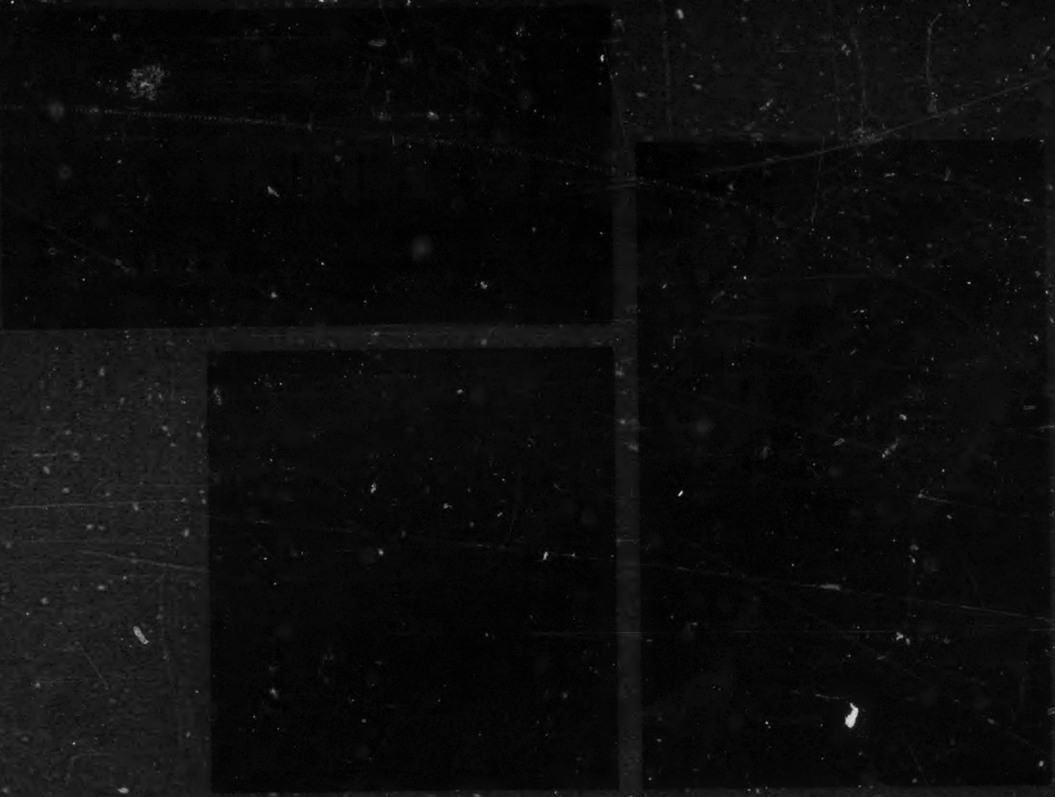
- How does the secondary treatment process used affect the potential for reclamation? The existing 100 to 150 mgd "coarse bubble" aerated effluent is reasonably amenable to reclamation. "Fine bubble" air aeration is probably equivalent. "Oxygen" aerated effluent is least amenable for reclamation, however, it is also less costly and is therefore the City's preferred treatment option for the entire facility.
- Should progress toward complete secondary treatment for the system be delayed to complete studies of the viability of the proposed La Cienega reclamation plant?

These issues are explored in the main text and in Addenda #1 and #2.

5. OTHER ISSUES

A number of additional issues are explored in the EIS. These include:

- Chlorination. The need for disinfection of the effluent before discharge.
- Replacement of the existing secondary treatment. In addition to the reclamation impact, this issue revolves about the impact on the marine environment of discontinuing secondary treatment for a period of years while "oxygen" aerated secondary facilities are constructed.
- Storm period overflows. Approximately once per year, an overflow occurs from a sewer into a flood control channel and occasionally other lesser overflows also occur. Prevention of these overflows is a legal requirement and a main goal of the Facilities Plan.



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Chapter II

description of environmental setting

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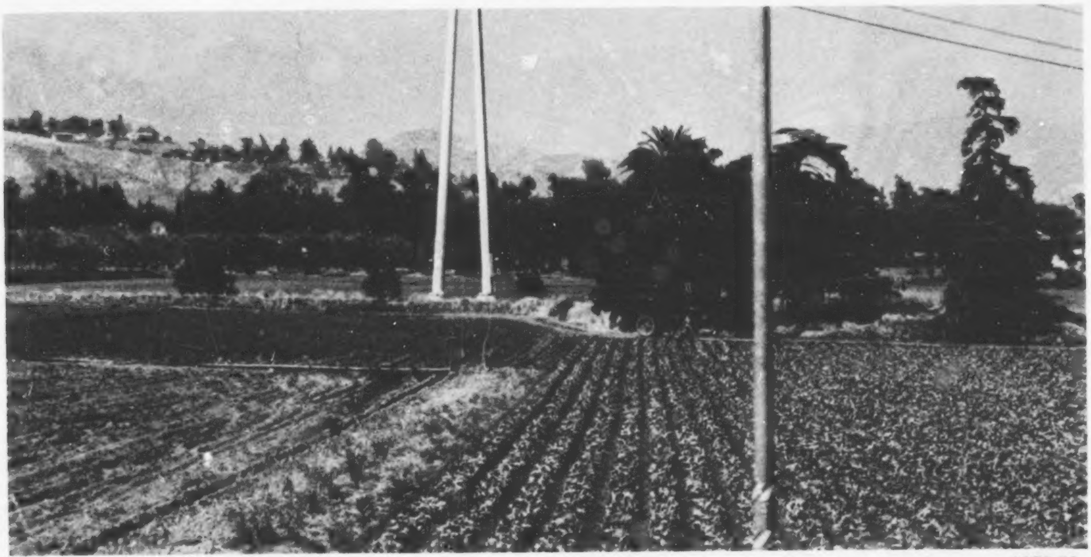
A. INTRODUCTION

This chapter of the EIS presents those characteristics of the existing Los Angeles environment that could potentially be affected by implementation of the Facilities Plan. This detailed description of the existing environment establishes a baseline so that impact-causing elements can be overlaid and future changes associated with Facilities Plan alternatives can be predicted. The relative importance of these changes provides a basis for determination of mitigative measures designed to produce the maximum environmental benefit to the residents of Los Angeles and neighboring communities.

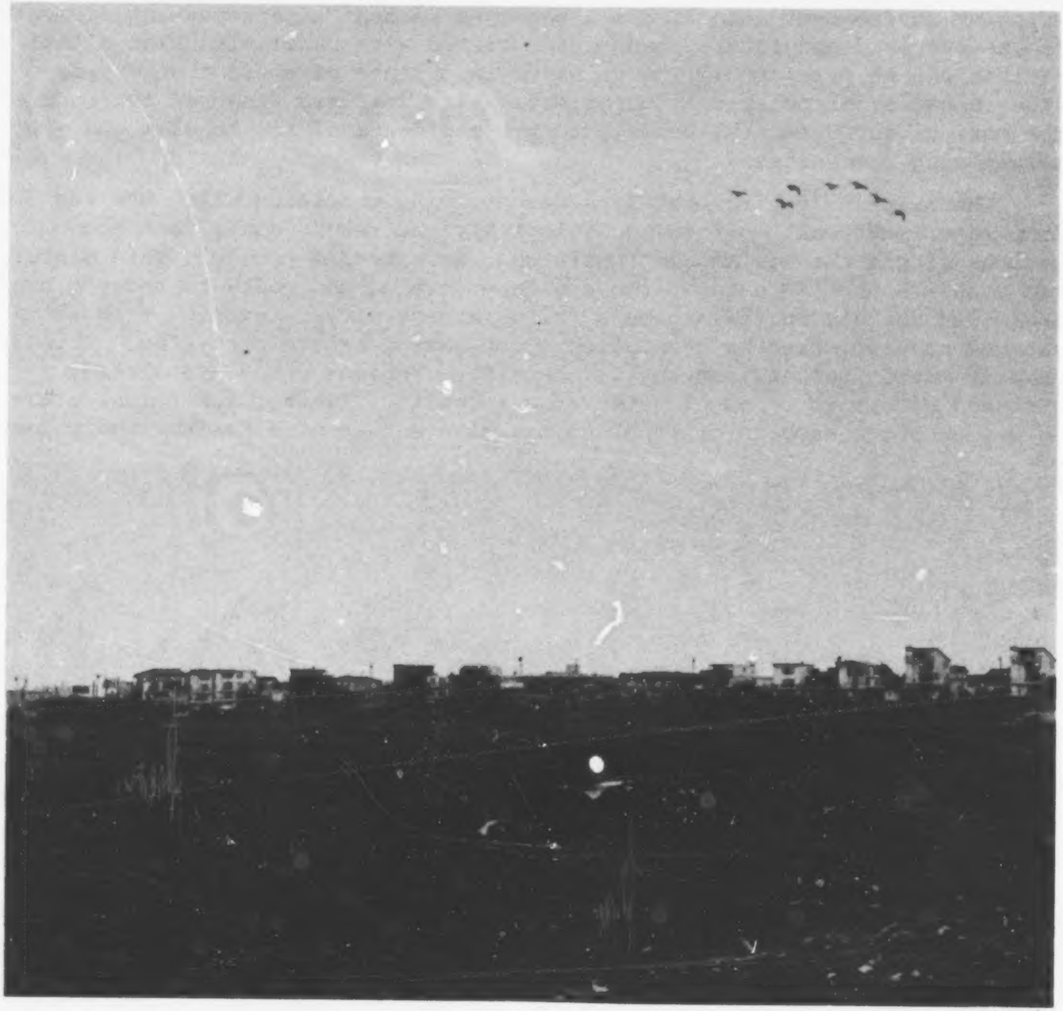
The existing environment is in an evolving condition which has resulted from major physical, conforming biological, and recent social and economic actions within the Los Angeles Basin over an extended period. This century has seen Los Angeles change from a sleepy farming community to today's highly urbanized society in the nation's third largest city. Certain of those changes have affected or been affected by sewage treatment system. This chapter identifies environmentally sensitive regions which are already stressed either in terms of water or air quality, lack of sufficient utilities, or other aspects critical to the maintenance of a healthy environment.



198P-68

Typical of the rural farming nature of old Los Angeles is this scene in present Los Angeles at the foothills of the San Gabriel Mountains.

The changing nature of the Los Angeles land and its use, circulation of transportation units such as automobiles and potential mass transit, established public services including sewage treatment, police, schools, fire departments, and the utilities which furnish water and power to the millions of people, all combine to produce the present City character. The interaction of these elements with the biological, physical, and socioeconomic aspects of the community contributes either positively or negatively to the quality of life in various portions of the City. In Chapters IX and X this information is used to project to the Los Angeles City of tomorrow and to evaluate the effects of the availability or lack of availability of wastewater treatment facilities upon different sections of the community.



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One of the few remaining marine estuaries in Southern California is in the Hyperion Service area south of Ballona Creek.

The 35 planning areas which have been officially adopted by the City of Los Angeles are discussed and evaluated so that environmentally sensitive areas can be defined. An overlay technique that is semiquantitative in nature is used to identify those areas which appear to be the leading candidates for additional residential, commercial, or industrial growth. The physical, biological, and socioeconomic ability of the environment to accept this expansion and maintain its general attractiveness will be considered in the discussion of mitigative measures. This analysis will be important in determining to what extent the proposed new treatment capacity can affect growth in the area due to inter- and intracity migration.

The interactions of physical, biological, and socioeconomic features can be seen in the satellite false-colored infrared photograph in Figure II-1 and on the cover of this EIS. Well-watered vegetation including golf courses and parks are deep red in the photograph, well-vegetated mountainous areas reddish, water areas dark, and concrete and developed areas various shades of green. The hilly Palos Verdes Peninsula with the Harbor area to the right, are clearly visible in the lower center of the photograph. The Terminal Island Treatment Plant is located in the Harbor area to the east or right of the peninsula. The coastal plain with the marina at Marina del Rey is visible. Ballona Creek drains into the Santa Monica Bay immediately adjacent to the marina. South of the marina, the runway for the Los Angeles International Airport can be distinguished. The Hyperion Treatment Plant is adjacent to the ocean near the end of the runway.

At the left corner, or western edge of the photograph, the Santa Monica Mountains meet the Pacific Ocean. North of the Santa Monica Mountains is the largely developed San Fernando Valley. The only valley areas with large tracts of nonurban land (red in the photograph) are flood control basins and the extreme northwest end of the valley.

The San Gabriel Mountains in the upper portion of the photograph reach elevations in excess of 10,000 feet. Just north of the Santa Monica Mountains, in the San Fernando Valley, is a large deep red area reflecting the well-irrigated Sepulveda Flood Control Basin. The well-vegetated Santa Susana Mountains form the north border of the Valley. At the eastern end of the Santa Monica Mountains where the San Fernando Valley is cut off by the Verdugo Mountains is the Los Angeles Narrows (slightly left of center portion of the photograph). The bright red area at the easternmost end of the Santa Monica Mountains is the irrigated portion of Griffith Park. The river can be traced in a stepping manner from the narrows east and south through the center of the photograph to the light green vertical line which is the concrete-lined Los Angeles River. At the lower end of the channel the brackish marine waters intrude into the river channel.

The satellite photograph suggests the desirable characteristics of the Los Angeles area, with a mild, Mediterranean climate, varied opportunities for residential location and recreational activities, and well-developed commercial and employment centers. Ironically, these desirable characteristics, including the ocean, the climate, the topographical barriers and

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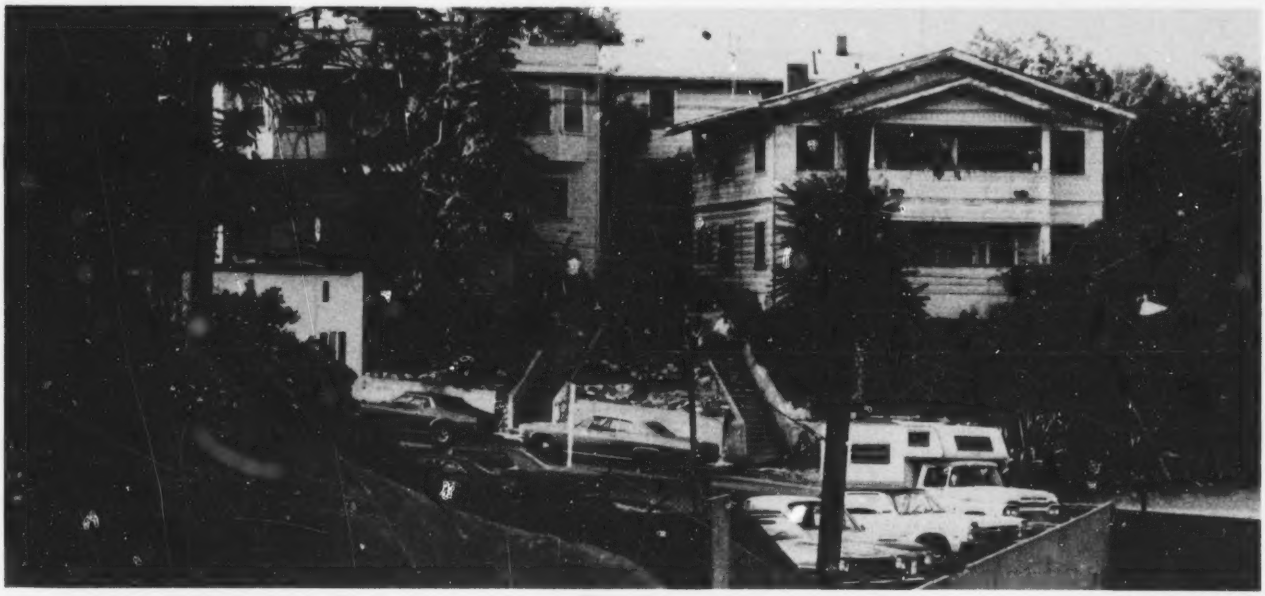
198P-16

Figure II-1. False-colored infrared photograph of the Los Angeles Basin. Water areas are dark, well-watered vegetation is bright red, and developed areas are green. Snow is in the northeast on the San Gabriel Mountains.

the rural, low density automobile dependent development combine to produce air and water quality relationships that tend to negate certain desirable features. Both the desirable and undesirable aspects of the existing environment are presented as a baseline in this chapter.



198P-70

The intermingling of various land use types can provide close access to employment or can lead to neighborhood decline. These multiple-family residences are immediately across the Harbor Freeway from the City Center.

B. history of the study area

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B. HISTORY OF THE STUDY AREA

1. AREA GROWTH PATTERNS

The spatial pattern and population trends in the study area are the result of a unique interaction of climate, the transportation system, large areas of flat, buildable land, the nature of local developers' practices, the availability of utilities, economic factors that determined the nature and timing of development, and the aspirations of people who migrated to Southern California. In order to have a perspective on future growth and its probable spatial distribution, the City of Los Angeles' historical development and the role public and private planning had on that development must be explored in some depth.

From its founding in 1781 until late in the 19th Century, the City of Los Angeles was a marketing center for the area's ranches and an agricultural producer utilizing the waters of the Los Angeles River. At the time California was admitted to the Union in 1850, the City was approximately 28 square miles with a population of 1,610. The discovery of gold in California did not bring settlers to Southern California (Los Angeles lost several thousand inhabitants to the gold fields) but did increase the demand for the agricultural produce of the region. Los Angeles' basic deficiency was transportation. With improved links to the ocean, access to shipping could increase its exports. By 1869, the first railroad line was completed to San Pedro, the second line was completed to Santa Monica in 1875. In 1876, the Southern Pacific Railroad line was completed to San Francisco, giving Los Angeles access to regional and national markets. A severe depression in the 70s restrained growth. With the completion of a second transcontinental railroad, the Santa Fe, in the mid-1880s, Los Angeles produce became even more accessible to eastern markets. Economic recovery and vastly improved transportation created a population boom, quintupling the population from 11,183 in 1880 to 50,395 in 1890. An important cause of this growth was the convenience and relative ease with which Los Angeles could be reached. The competition between the Santa Fe and Southern Pacific Railroads compounded this—fares became as low as $1.00 from Kansas City to Los Angeles, and a large advertising campaign lured thousands with glowing descriptions of enormous amounts of inexpensive land, free of cyclones and blizzards. Some seaports and coastal resorts were also developing, but neither the Outer Coastal Plain nor the San Fernando Valley could accommodate a large population increase until the 20th Century. Many localities suffered from poor drainage, excessive depth to groundwater and/or inadequate transportation (Lantis, Steiner, and Karinen, 1973).

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2. THE SAN FERNANDO VALLEY DEVELOPMENT

The arrival of the Pacific Electric (P.E.) interurban in 1887 in Southern California promoted the dispersal of residential growth which in turn enabled profitable housing tracts to be built. The lines, radiating from downtown out to the beach communities and east to the base of the San Gabriel Mountains, encouraged a wide population distribution along railroad corridors.

Perhaps the biggest single real estate development that the P.E. Lines opened up was in the San Fernando Valley. Prior to the large land boom in the Valley, small isolated cores of development such as North Hollywood, Chatsworth, and Van Nuys had developed at the junctures of large aricultural tracts. These activity nodes developed in the main because of the commercial needs of the farming community. Although comparatively isolated from other sections of Los Angeles by mountains, the Valley was an obvious area for the eventual overflow of population. The San Fernando Valley had a brief period of development when the Southern Pacific passed through the area as it built its line from San Francisco to Los Angeles in 1874. The town of San Fernando was established, but the infrequent service of the steam railroad failed to spur development at that time although the existence of the line would shape future industrial development in the Valley (Crump, 1962).

A mild beginning to the population boom that eventually filled the Valley basin with homes and commercial centers came in 1904 when Leslie C. Brand, a real estate developer, organized the San Fernando Mission Land Company. Associated with him in the company were a group of men whose interests could profit not only from the sale of land but also in its subsequent use. During this period, the company successfully developed Glendale and a P.E. Line established to Glendale made it a thriving bedroom community for the City of Los Angeles. Four towns were also established: Zelzah (Northridge), Marian (Reseda), Owensmouth (Canoga Park), and Van Nuys (Lantis, Steiner, and Karinen, 1973). Other parts of the Valley remained as ranches and fruit orchards.

The three things that were needed to develop the Valley more fully were an abundant supply of water, low-cost electricity, and an adequate transportation system linking the Valley with major employment centers in downtown Los Angeles. The Valley was dry and desert-like, and irrigation farming was modest in extent. In Los Angeles itself, a severe drought between 1893 and 1904, in combination with great population increase over this period (from 66,019 to 175,000), created a near crisis in water supply. An alternative view is that the "water crisis" was artificially created to make cheap water available for the development of the San Fernando Valley (Fellmeth, 1973). However, the same growth which contributed to the City's water shortage also made it the only community in the area with sufficient size and wealth to go beyond the limits of the local watershed to gain additional water (Warren, 1966). One significant reason why growth concentrated in Los Angeles rather than dispersing into a large number of smaller communities in the San Fernando Valley and the upper coastal plain was Los Angeles' establishing prior rights to the Los Angeles River water source and limiting their use by others (Brigger and Kitchen, 1952).

A detailed study of the alternatives for obtaining water in the Los Angeles Basin was made. City officials subsequently approved a plan to bring water to Los Angeles via a 250-mile aqueduct from the Owens Valley on the eastern slopes of the Sierra Nevada Mountains at a cost of $25,000,000. The proposal was announced to citizens in 1905, and was approved at a municipal election in 1907, with a successful vote on a bond issue to finance the project. As a result, construction on the aqueduct began in 1908 (Warren, 1966). In September 1909, an option to purchase 47,500 acreas of land in the San Fernando Valley was taken. At that time, the price of the land was $2.5 million, or a little more than $45 per acre (Crump, 1962). A year later, water was assured and the option was exercised. "Tract 1,000" was the official designation given to the giant subdivision recorded in 1911 by the Los Angeles Suburban Homes Company. At the time, the need of interurban service to assure the success for a real estate development was well known. Rails were regarded as being second only to water in importance for saleable land. For this reason, the land development company found it prudent to incorporate the Los Angeles and San Fernando Valley Railway Company when development operations were started. The railway company, including right-of-way tracks, became part of the Pacific Electric which actually built the line beginning in 1911. The link from the Hollywood line through the Cahuenga Pass was completed in December 1912, and a massive program to sell lots was launched despite the fact that the first water from the Owens Valley project would not arrive until 1913. The Los Angeles County surveyor divided the land into lots of varying sizes, many suited for small farms and others for homes (Crump, 1962).

The importation of water also provided the beginnings of the City's municipal electricity system. The fall of water as it traveled from the eastern Sierra Nevadas was utilized in hydroelectric installations. The San Francisquito Hydroelectric Plant No. 1 was placed in service in 1917, initiating municipally-generated, low cost power for the City of Los Angeles. Developers, uninhibited by public regulation and assured of transportation and utilities, subdivided large tracts very profitably. In these early development stages, developers were responsible for financing their utilities, which increased their costs but afforded them great locational flexibility (Environmental Science and Engineering, and the School of Architecture and Urban Planning, University of California at Los Angeles, 1975).

Between 1915 and 1920, Los Angeles added over 250 square miles to its boundaries, enlarging its size by nearly two and one-half times. Nearly all of the San Fernando Valley (170 square miles) and large portions of the Cahuenga district accounted for the bulk of the increase. Los Angeles' water monopoly left annexation as the only means of gaining sufficient water for the development of adjacent areas (Warren, 1966). Although most Valley communities did not elect to join Los Angeles immediately, water shortages forced most of them to merge with the City within the decade: Canoga Park (1917), Chatsworth (1920), and North Hollywood (1923) (Lantis, Steiner, and

Karinen, 1973). After the Metropolitan Water District was formed in 1928, however, Los Angeles' monopoly on external water sources and thus its bargaining position for consolidating the area through annexation were ended (Warren, 1966).

To accommodate its population growth, the capacity of the City's sewage system had to be increased and the submarine outfall built in 1894 at Hyperion had to be extended to abate pollution of the beaches. To solve these two problems, the voters of Los Angeles approved a $12,000,000 bond issue in 1922; the system was subsequently completed in 1925. As part of the project a tunnel was built through the Santa Monica Mountains to connect the Valley with the City's sewage lines and ultimately to Hyperion. Unlike its water supply annexation policy, the City contracted out its sewer services to a number of surrounding jurisdictions so that by 1930 the City was serving as a wholesaler for 16 adjacent municipalities (Warren, 1966).

3. INFLUENCE OF THE PACIFIC ELECTRIC ON SOUTHERN CALIFORNIA'S URBAN FORM

For other sections of the United States, the invention of the trolley provided little more than another mode of transportation: the urban pattern of these cities was formed prior to building of the electric lines which only supplemented the existing railraods. However, the technology of the interurban came at the time Southern California was on the verge of its greatest population growth. From 1900 to 1930, the City's population had increased from 102,479 to 1,238,048 making it the nation's fifth largest city and its incorporation area had expanded by approximately 400 square miles. This growth was nurtured primarily by the national prosperity which created intense economic activity in Southern California. Following the development of local oil fields after 1892, with the consequent rise in the oil refining industry, a southward trend in California manufacturing began to develop. The construction of a harbor at San Pedro and the subsequent ship building during World War I as well as the development of the tool, automobile, rubber processing, and slaughtering and meat packing industries created a strong industrial base. By 1919, the Census of Manufacturers ranked Los Angeles as one of the leading industrial centers of the Nation (Coons and Miller, 1941). As southeast Los Angeles became the primary center for industry and wholesale warehousing, the more affluent citizens moved from Bunker Hill and Boyle Heights to the western and northern fringes of the City, including the San Fernando Valley, and commuted to work with the aid of the trolley system.

In the 1920s, many moved to Los Angeles because of the inflated farm land costs in the mid-West and lack of demand for labor in the eastern industrial sectors (Coons and Miller, 1941). The factors which drew these migrants to Southern California were multifold. First of all, it was during this time that the newly discovered oil fields of the Los Angeles Basin were undergoing rapid development, giving employment to thousands. Between

1917 and 1929, 15 new oil fields were discovered and the newly opened Panama Canal enabled petroleum export to the East Coast as nationwide consumption mounted with use of the automobile. This oil production stimulated both the development of oil refineries between Wilmington and El Segundo (convenient locations for oil export) and the erection of oil corporation headquarters in downtown Los Angeles. Secondly, with the close of the war, the manufacturing industry entered an era of rapid development, replacing agriculture as the dominant activity of the economy. Finally, the publicity generated by the movie industry and aggressive advertising campaigns attracted many tourists and retired persons to the Southern California area (Coons and Miller, 1941). These factors combined to produce a doubling of population in the City of Los Angeles from 1920 to 1930 (576,673 to 1,238,648) and in the four Southern California counties of Los Angeles, San Bernardino, Riverside, and Orange (1,121,528 to 2,542,090) (Warren, 1966). Most of the increase can be attributed to immigration from other parts of the country; Table II-1 indicates the importance of immigration vis-à-vis population increase for Los Angeles County from 1900 to 1939.

This economic and population growth occurred at the peak of the Pacific Electric's operations. The system reached its maximum extension in 1926 when its tracks stretched for 1,164 miles, representing a doubling of track in only 15 years (Crump, 1962). Automobiles were only on the verge of making important inroads on commuter traffic and buses had not yet become a competitive factor. As a result, residents relied almost entirely on the Pacific Electric. Its lines radiated in five basic directions from downtown Los Angeles: to Glendale and Burbank, to the San Fernando Valley through Hollywood, westward to Santa Monica, south to Long Beach, and eastward through the San Gabriel Valley (see Figure II-2).

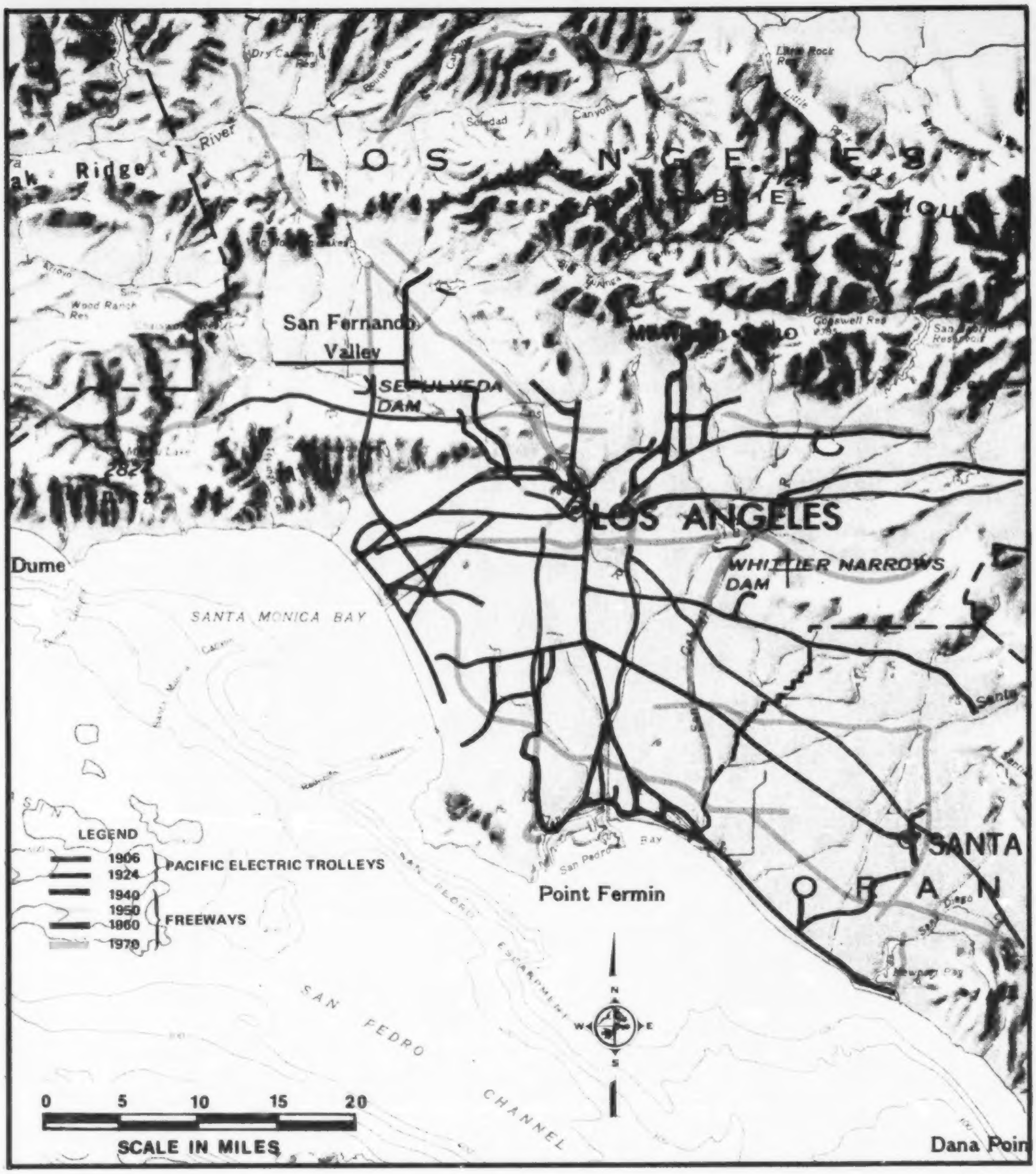
It was the trolley lines which set the stage for the development of Southern California in areas that otherwise may have remained grazing land. By making it easy for new residents to reach these areas, the cities of Southern California took on a horizontal urban pattern, making suburban home living an established way of life. The low cost, efficient and convenient trollys which made the orange groves, seashore, mountains, villages, and cities accessible encourage visitors to locate permanently in Southern California. Few of those who located in Southern California considered purchasing a home unless it was convenient to the trolley lines. Subdivisions, towns, and city centers developed on land which was in greatest proximity to the Pacific Electric tracks. Of the thirteen cities incorporated in Los Angeles County between 1910 and 1919, all but one was located on the interurban line (Crump, 1962). The track network also promoted commercial development at various trolley stops in the City of Los Angeles. This resulted in intense commercial development originating from the central city westward along Wilshire and Santa Monica Boulevards to Westwood. The City of Los Angeles then over-zoned miles of commercial uses along these and other P.E. boulevards, in effect reinforcing the market's land development patterns.

Table II-1. Sources of population increase in Los Angeles County, 1900-1940 (Coons and Miller, 1941).

DECADE	POPULATION AT START OF DECADE	INCREASE DURING DECADE	PERCENT INCREASE	CAUSE OF NET INCREASE	
				BIRTHS-DEATHS	IMMIGRATION
1900-1910	164,838	331,281	201.0%	-4,085	335,366
1910-1920	496,119	440,398	88.8%	16,328	424,070
1920-1930	936,517	1,271,975	135.8%	89,005	1,182,970
1930-1940	2,208,492	577,151	26.1%	58,270	518,881

The population boom which the trolley system had helped to disperse throughout the City of Los Angeles and the four-county area created a problem for the Pacific Electric interurban—the increasing ownership of automobiles in the region. In 1919, the four counties served by the interurban had 170,195 automobiles; by 1927, this number had increased to 693,175 (Crump, 1962). More automobiles increased the demand for more and wider highways. To build the highways as cheaply as possible, more arteries were cut across the interurban track, causing trains to increase running time. In 1916 appropriations for road construction throughout California approached $10 million (Crump, 1962). Paved highways began to form a network over the Southern California region, allowing an even wider dispersion of population. Had under- and over-passes been constructed and the railway rights-of-way been protected as those of the freeway were in the 1950s, the electric interurban might have remained economically useful for many years. Attempts were made to build such separations through public and private funding, but there were too few viaducts built to be useful. Those that were built were built too late. Road construction increased as the pressure to place all available funds into paved roads came from car manufacturers, automobile owners, and others who would benefit from such construction (Crump, 1962). The reduction in traveling time was the main excuse for commuters to abandon interurbans in favor of automobiles, a situation which eventually resulted in difficult automobile traffic problems. The number of passengers riding the trolley system peaked in 1924 at 109,185,650 and then began to decline. By 1927, the company had begun to substitute bus routes for trolley lines, further reducing the use of the fixed rail system. As Figure II-3 shows, this decline continued with only a brief leveling off during World War II.

While the competition of automobiles and "invasion" of the rights-of-way caused the ultimate demise of the trolleys, the burden of the Pacific Electric's bonded indebtedness and the reluctance of the commuting public to pay increased fares were also major contributing factors. The critical role that General Motors Corporation played in phasing out the Pacific Electric system is less widely known. According to a study completed in 1973 by the Stern Fund of New York, General Motors played a dominant role in



LOS ANGELES
San Fernando Valley
SEPULVEDA DAM
LOS ANGELES
WHITTIER NARROWS DAM
SANTA MONICA BAY
Dume
SANTA
ORAN
Point Fermin
SAN PEDRO CHANNEL
Dana Point
LEGEND
1906
1924
1940
PACIFIC ELECTRIC TROLLEYS
1950
1960
1970
FREEWAYS
0 5 10 15 20
SCALE IN MILES
N S E W

198 P-71

Figure II-2. Growth of Los Angeles transportation system.

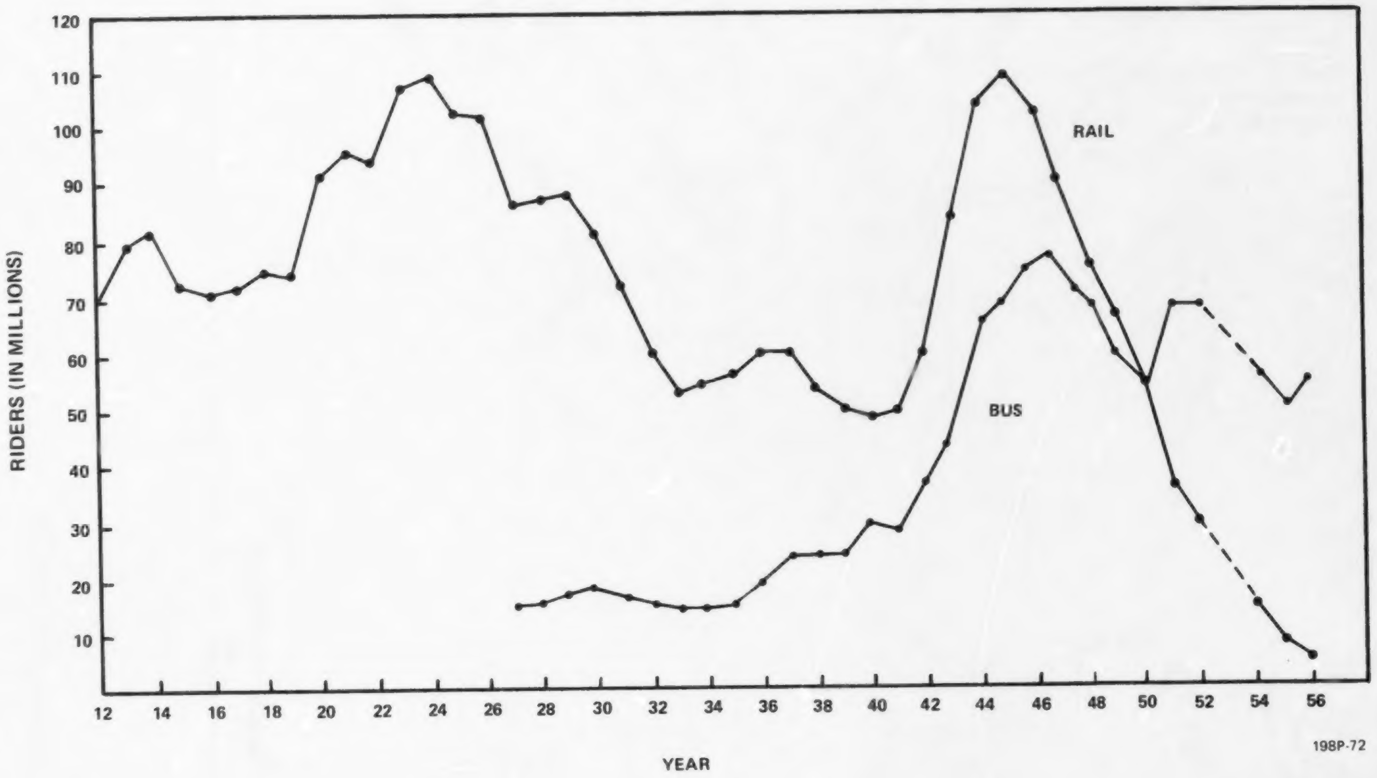
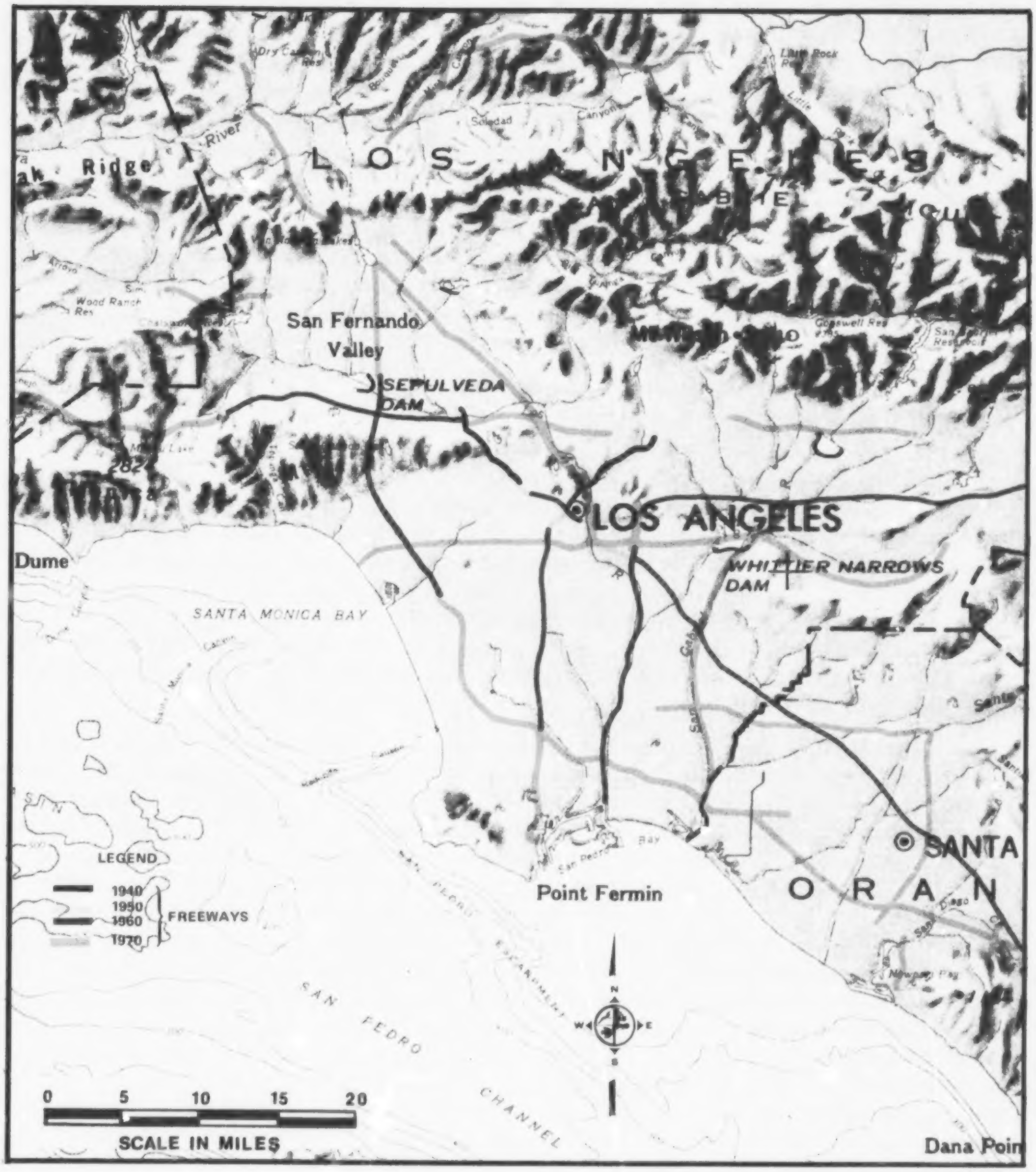


Figure II-3. Annual passengers on Pacific Electric (1912 to 1956) (Crump, 1962).


Ridge
River
LOS ANGELES
San Fernando Valley
SEPULVEDA DAM
LOS ANGELES
Dume
WHITTIER NARROWS DAM
SANTA MONICA BAY
SANTA
ORAN
Point Fermin
San Pedro Bay
SAN PEDRO CHANNEL
SAN PEDRO ESCARPMENT
LEGEND
1940
1950
1960
1970
FREEWAYS
N
S
E
W
0
5
10
15
20
SCALE IN MILES
Dana Poin

198P-425

Figure II-4. Freeway Development 1940-1970.

destroying more than 100 electric surface rail transit systems in 45 cities—including Baltimore, Philadelphia, New York, St. Louis, and Los Angeles—between 1932 and 1956. The study reports that in 1932, the corporation formed a subsidiary, United Cities Motor Transit, which had the sole function of buying electric rail transit systems, converting them to GM buses and finally reselling them to operators who would buy GM replacement buses only. After protests from the American Transit Associations, GM abolished the subsidiary but established the National City Lines (with Standard Oil of California and Firestone Tire Company) to convert 16 states to buses. In 1940, National City Lines began to acquire and scrap parts of the Pacific Electric, finally motorizing downtown Los Angeles; the trolley line eventually went out of service in 1961 (Mintz, 1973).

4. URBAN DEVELOPMENT FROM 1930 TO THE PRESENT

As the trolley system began to decline in ridership, the automobile became the primary determinant of community development patterns in Los Angeles County. In fact, the automobile may have affected community development patterns in Los Angeles more than it has those in any other major American metropolitan area (Bigger and Kitchen, 1952). Automobiles have given the population greater freedom of movement and have permitted the establishment of homes without regard to existing rail patterns. This development, coupled with cheaper land in Los Angeles, has permitted every community to grow horizontally rather than vertically.

Commercial development in Los Angeles also began to reflect the impact of the automobile. In downtown Los Angeles, auto congestion grew, encouraging commercial and industrial dispersion. Increased wealth in some suburban communities had already provided a market for community retail business and these outlying retail areas began to absorb the dispersing businesses. Communities along the Wilshire Boulevard corridor were among the first to be developed in this manner. In 1925, the University of California at Los Angeles in Westwood began to spur commercial growth in another center along the City of Los Angeles-City of Santa Monica axis, made increasingly accessible by the automobile. Commercial activity also began to desert downtown Los Angeles for the open spaces of the City along Wilshire Boulevard. Bullocks-Wilshire department store was built in 1928 west of downtown with a rear entrance facing a parking lot behind the building, clearly oriented to automobile-borne shoppers. The May Company store at Fairfax and Wilshire, built in 1939, typifies the development of the Wilshire Miracle Mile specialized to accommodate the interaction of the automobile and urban commerce. It has been called the first real monument to the motor age because of its revolutionary orientation of tall buildings bounding a street, backed by parking lots and garages, running through residential developments (City of Los Angeles Community Analysis Bureau, 1973).

The automobile also had its affect on the suburban environment of Los Angeles. This environment as of 1930 had been characterized as having little or no acres devoted to community facilities, prohibiting commercial enterprises in residential areas, indistinguishable regions, almost exclusive use of cars and a high degree of residential mobility resulting in little neighborhood identification (Fogleson, 1967). Little of this development had been affected by the establishment of the Los Angeles Department of City Planning whose first major commitment was to facilitate suburban patterns by concentrating on measures to ensure the flow of auto traffic. These subdivision regulations for improved traffic flows proved incomplete; there was no means of controlling the developed land. The first comprehensive zoning ordinance was passed by the City Council in 1921 which divided the City into five zones: single family residences, multiple dwellings, commercial, light industrial, and unrestricted (City of Los Angeles Planning Commission, 1951). To placate developers, planners stressed that zoning would stabilize realty values and supervise urban expansion. In this way, zoning reinforced land use segregation in Los Angeles by investing the patterns imposed by private enterprise with governmental sanctions (Fogelson, 1967). Overtime land designated by special zones was developed for other uses as population increases overwhelmed zoning.

During the 1930s, growth in the City of Los Angeles slowed somewhat, increasing from 1,238,048 in 1930 to 1,504,277 in 1940; the County of Los Angeles gained more than one-half million people, increasing from 2,208,492 to 2,785,043 (Table II-2). Ninety percent of this increase was due to immigration and represented approximately one-half of the total immigration to the State of California (Coons and Miller, 1941). In the Los Angeles area, the effects of the nation-wide depression were mollified by the expansion of the apparel, furniture, and motion picture industries. The latter capitalized on newly introduced sound and color techniques. As a result, employment in the movie making industry doubled between 1933 and 1937 (Lantis, Sterner, and Karinen, 1973). Urbanization was particularly vigorous on the western Coastal Plain and in the southern San Fernando Valley, locations preferred by the movie, recording, and radio broadcasting industries. As shown in Table II-2, the most spectacular growth occurred in the San Fernando Valley and the City of Burbank. In the Valley, agricultural decline of the southeast resulted in the disappearance of dairies, poultry farms, fruit packing plants, and nurseries. Toward the northwest, however, the Valley remained agricultural. In the northwest corner, 10,000 acres in the Northridge district were converted into ranches, as affluent people established residences (Lantis, Steiner, and Karinen, 1973).

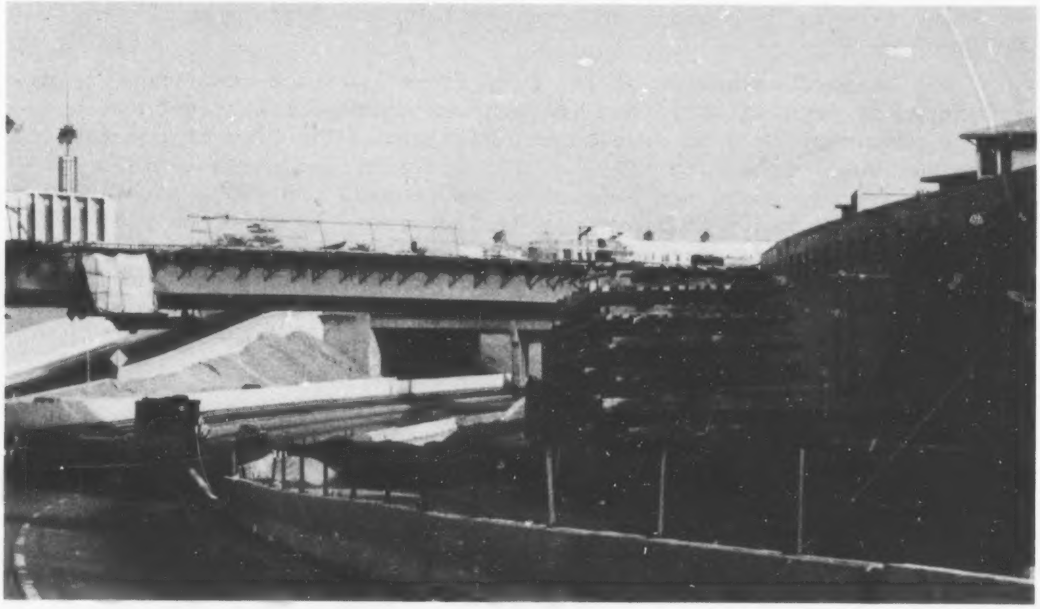
During and following World War II a number of factors influenced the regional development pattern, including high employment in the burgeoning aircraft and motion picture industries, high in-migration, and high marriage rates and accompanying birth rates. These led to demands for additional housing; and federal support for the homebuilding industry, federal and state loan policies, tax incentives favoring single family home purchases, inexpensive peripheral land, and higher incomes provided the supply (SCAG, 1975).

Table II-2. Historical population growth for the City of Los Angeles and contract cities (1930 to 1970) (Bureau of the Census, 1970).

CITY OR AREA	1930	PERCENT INCREASE	1940	PERCENT INCREASE	1950	PERCENT INCREASE	1960	PERCENT INCREASE	1970
San Fernando Valley	54,217	106.6	112,001	177.6	310,962	137.6	738,831	30.7	966,055
Central Los Angeles	1,070,007	13.8	1,218,186	9.4	1,333,304	-4.3	1,278,155	4.9	1,340,508
West Los Angeles	59,754	83.8	109,851	111.7	232,560	45.9	339,333	4.8	355,636
South Los Angeles	54,070	18.8	64,239	45.6	93,532	31.2	122,696	24.7	153,042
Los Angeles TOTAL	1,238,048	21.5	1,504,277	31.0	1,970,358	25.8	2,791,801	13.6	2,815,239
Beverly Hills	17,429	53.9	26,823	8.2	29,032	6.1	30,817	8.4	33,416
Santa Monica	37,146	44.0	53,500	33.8	71,595	16.3	83,249	6.1	88,289
Culver City	5,669	58.3	8,976	120.8	19,720	62.3	32,163	7.0	34,415
El Segundo	3,503	6.7	3,738	114.3	8,011	77.5	14,219	9.9	15,621
San Fernando	7,567	20.2	9,094	42.9	12,992	23.9	16,093	3.0	16,578
Burbank	16,662	106.1	34,337	128.8	78,577	14.7	90,155	-1.4	88,873
Glendale	62,736	31.6	82,582	15.9	95,702	24.8	119,442	11.1	132,664
Contract City TOTAL	150,712	45.3	219,050	44.1	315,629	22.3	386,138	6.1	409,846
TOTAL Los Angeles and Contract City Population	1,388,760	24.1	1,723,327	32.6	2,285,987	25.3	2,865,153	12.6	3,201,683

By 1950, segments of the Santa Ana and the San Bernardino freeways had been completed although the extent of the freeway system was too limited at this point in time to make a significant contribution to the growth and form of the region. An exception may be the Hollywood Freeway, which facilitated the rapid growth of the San Fernando Valley by making downtown employment centers within easy commute of Valley bedroom communities. During this war-stimulated decade, the region's spectacular growth rate continued, increasing the population by a total of more than 50 percent (Gruen Associates, 1974). This growth generally followed the Red Car network, with growth characterized by a combination of multi-centered expansion (primarily of a low-density residential nature) and infilling.

The present urban pattern in Los Angeles was largely shaped in the post-World War II period. During that time, the Valley experienced a tremendous population surge; as shown in Table II-2, the population of the Valley within the City of Los Angeles increased from 112,000 in 1940 to 955,055 in 1970. Scores of housing tracts were created, varying from modest homes and apartments in Panorama City to luxurious hillside homes on the north slopes of the Santa Monica Mountains. Liberal FHA home mortgage rates, the route flexibility of the automobile, and the development of the freeway system linking outlying areas with employment


198P-73

The first generation Hollywood Freeway facilitated the rapid postwar growth of the San Fernando Valley. One of the earliest freeways, the Hollywood, was undergoing renovation during 1976 to increase its capacity.

opportunities combined to produce these Valley settlements on the urban fringes of Los Angeles. The Los Angeles Freeway system began in 1939 with the Arroyo Seco Parkway (now a portion of the Pasadena Freeway). After World War II, construction began on the State Freeway System. The portions completed during the early 1950s were the Hollywood Freeway from downtown to the San Fernando Valley, the link of the Pasadena Freeway from Avenue 22 to downtown, the Santa Ana and the San Bernardino Freeways to roughly the City limits on the east, and the Harbor Freeway from the southern extension of the Pasadena Freeway to Washington Boulevard. From this pattern, it is obvious that downtown Los Angeles was the primary center that people were interested in reaching. As the system became more complete, however, parts of the City became equally accessible. By 1960, the Ventura Freeway west from the Hollywood Freeway was completed, and the Harbor Freeway was completed to Alondra. The Santa Ana and San Bernardino Freeways were extended further into the eastern and southeastern suburbs, and the Long Beach Freeway connected the City of Long Beach to the San Bernardino Freeway. The bulk of the remaining freeway construction was during the early 1960s. During this time, the Santa Monica Freeway was completed and most of the San Diego Freeway was constructed. The Harbor Freeway was continued to San Pedro, the Golden State constructed, and the connection from the Golden State to the Ventura Freeway north of Hollywood was completed. Freeway construction projects in the City since 1965 have been primarily extensions or modifications of these routes (see Figure II-4), (City of Los Angeles Community Analysis Bureau, 1973).

The outward expansion of the City is reflected in the changing distribution of population in the Los Angeles metropolitan region as well as the accompanying land development patterns. The City of Los Angeles began to have a lessening share of the metropolitan population as automobile usage increased and annexation decreased. In 1900, the City's share of the metropolitan population was 84.7 percent, by 1950, only 45 percent or 1,970,358 of the Los Angeles metropolitan area population lived in the City itself (Thompson, 1955). This outward expansion of the population is illustrated in land development patterns which occurred from 1924 to 1970 (see Figure II-5); this trend continues to the present (Lantis, Steiner, and Karinen, 1973).

This dramatic growth in the post-World War II period and its effect on land use can be seen by comparing the number of acres in various land use categories before World War II to the number in the identical categories in 1960. As shown in Table II-3, the developed areas increased by 100 percent for virtually the same total area. Although the acreage devoted to industrial uses doubled and that devoted to commercial uses tripled, the most dramatic increase was in the number of acres devoted to residential use.

Generally, urban development in the Valley occurs along principal boulevards, often paralleling abandoned Pacific Electric interurban lines. Communities that were once separate and distinct geographically have become part of one conurbation. However, many districts have retained their names,

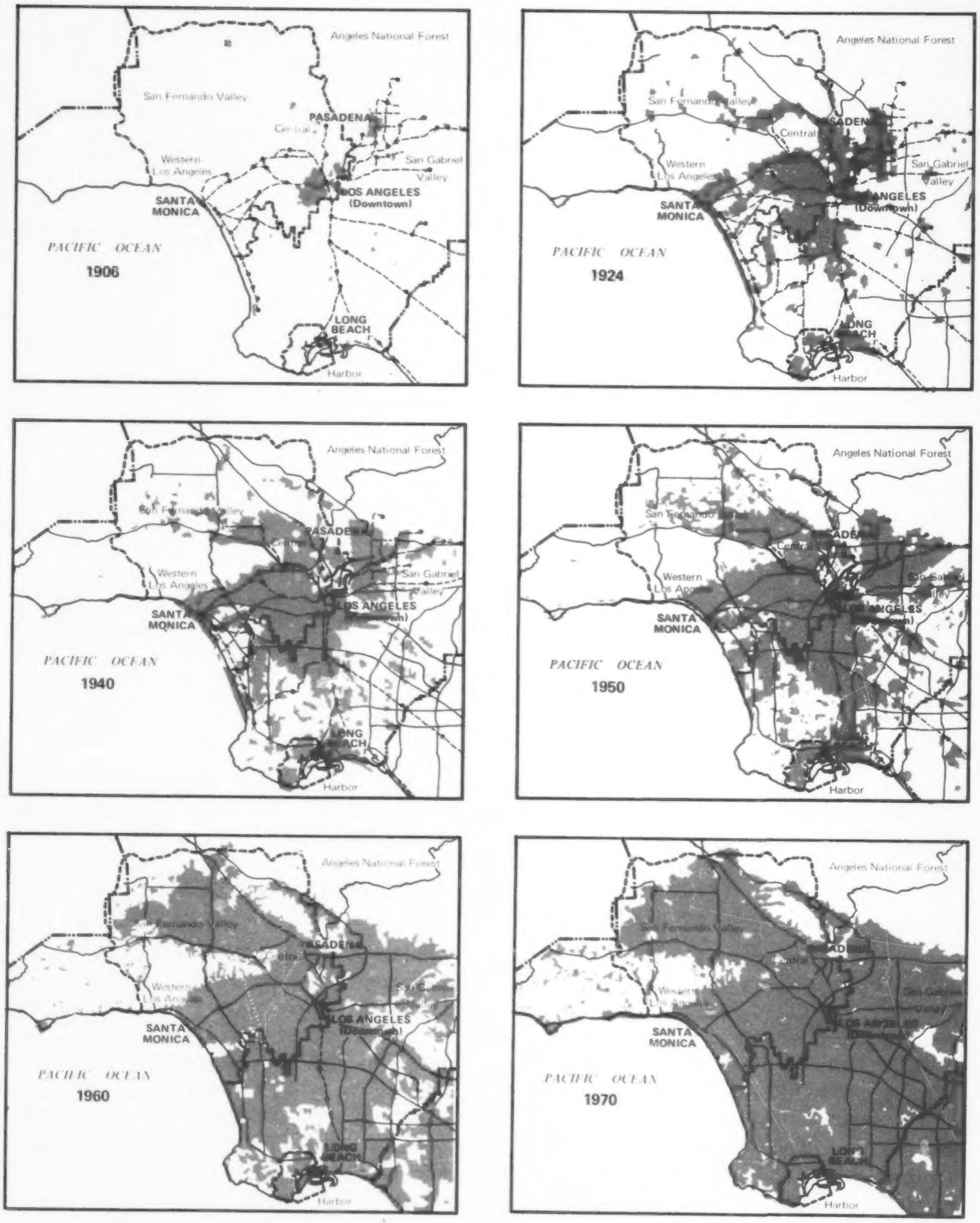

Angeles National Forest
San Fernando Valley
Central
PASADENA
Western Los Angeles
San Gabriel Valley
SANTA MONICA
LOS ANGELES (Downtown)
PACIFIC OCEAN
1906
LONG BEACH
Harbor
1924
1940
1950
1960
1970
198P-74

Figure II-5. Los Angeles urban development 1906-1970.

Table II-3. Net acres of land in Los Angeles by use categories (Niedercorn and Hearle, June 1963).

YEAR	RESIDENTIAL	INDUSTRIAL	COMMERCIAL	ROAD AND HIGHWAY	OTHER PUBLIC AND SEMIPUBLIC	TOTAL DEVELOPMENT	VACANT	TOTAL
1940								
Acres	39,697	10,618	4,137	37,223	11,028	102,703	185,119	287,822
Percentage of Developed Land	38.7	10.3	4.0	36.2	10.7	100.0	-	-
Percentage of Total Land	13.8	3.7	1.4	12.9	3.8	35.7	64.3	100.0
1960								
Acres	106,444	19,410	12,437	42,139	21,826	202,256	90,778	293,034
Percentage of Developed Land	52.6	9.6	6.1	20.8	10.8	100.0	-	-
Percentage of Total Land	36.3	6.6	4.2	14.4	7.4	69.0	31.0	100.0

and have their own retail districts, high schools, and community centers. North Hollywood is principally residential with commutation to nearby film studios and to downtown Los Angeles. The upper-middle-income residents of North Hollywood surround an exclusive residential enclave of Toluca Lake where many television and movie personalities live. An elongated shopping belt remains along Ventura Boulevard, the principal boulevard linking North Hollywood to Los Angeles. This boulevard also runs through Van Nuys along Southern Pacific trackage and around the Van Nuys Airport. The area bounded by the boulevard has many industrial uses, including an automobile assembly plant, several large breweries, missile producers, and electronic firms (Lantis, Steiner, and Karinen, 1973). Southern Van Nuys, known as Sherman Oaks, is linked to the Coastal Plain by two canyon boulevards across the Santa Monica Mountains.

The northern slopes of the Santa Monica Mountains in Sherman Oaks serve as a "spillover" area for luxury-priced homes of Beverly Hills and Westwood. Reseda, Canoga Park, and Woodland Hills, which were once small farm villages in the west valley, became the center of much tract development after the completion of the Ventura Freeway in 1961. Large new aerospace and electronic plants have prompted much of this growth. Inhabitants of the west San Fernando Valley tend to be more well-to-do and homogeneous than the eastern Valley. Single-family dwellings are more prevalent than in the longer-occupied area between Van Nuys and Glendale (Lantis, Steiner, and Karinen, 1973). Chatsworth in the northwest Valley remained essentially rural-urban until the mid-1950s. Subsequently, following the establishment of the North American Aviation facilities in the Santa Susana Mountains, much new housing appeared.

Despite a zoning study which was completed by Los Angeles City in 1944, the tremendous population growth in the Valley has made the achievement of a "planned" basin almost impossible in the 1970s. The City Planning Commission zoned portions of the Valley for industrial use, but Valley residents have been unenthusiastic about many types of manufacturing plants. Also, speculation has somewhat made land too expensive both in initial cost and property taxes for industrial use. Some of the earlier, hastily built tract homes are deteriorating over time, creating the necessary preconditions for future slums. A public rapid transit is being suggested but it is doubtful that dispersed settlement would allow economic service in the Valley. Small to medium sited public recreational facilities are limited, but much use has been made of the larger Hansen and Sepulveda flood-control basins as well as of Griffith Park. The western San Fernando Valley with access via the Ventura Freeway had thousands of acres of vacant land that was zone agricultural or residential although much of the agricultural land was planned for industry (Lantis, Steiner, and Karinen, 1973).

Generally, there has been a continuing outward spread of urbanization across the Coastal Plain and into the San Fernando and San Gabriel Valleys. The contiguous built-up metropolis now extends more than 20 miles from downtown Los Angeles wherever there is level land. The urban fringe now lies more than 25 miles from the downtown area along the Ventura, San Bernardino, San Diego, and Santa Ana Freeways. Greatest expansion is now directed into the northwest-southeast corridor between the ocean and mountain barriers. Urbanization of the Coastal Plain and the central and eastern San Fernando Valley is virtually complete.

5. CULTURAL RESOURCES

Historical, paleontological, and archaeological sites and structures are numerous throughout the Los Angeles wastewater service area. There are over 245 known historical structures or places of interest in the entire service region officially recognized or potentially defineable as preservable under historical preservation ordinances. There are also over 70 known paleontological sites where fossils have been recorded and well over 100 archaeological sites within Los Angeles City boundaries alone. In addition there are large areas of the city which are likely to yield unrecorded sites, but which have not yet been extensively surveyed. Chief among these is the Santa Monica Mountain range (Figures II-6 through II-8). Discussion of these kinds of sites and areas is necessarily limited to those that are known and have been identified. There is every possibility that other sites and structures exist but have not been mapped. Full copies of the archaeologist's report and of the historic-cultural documents are in Appendix IV.

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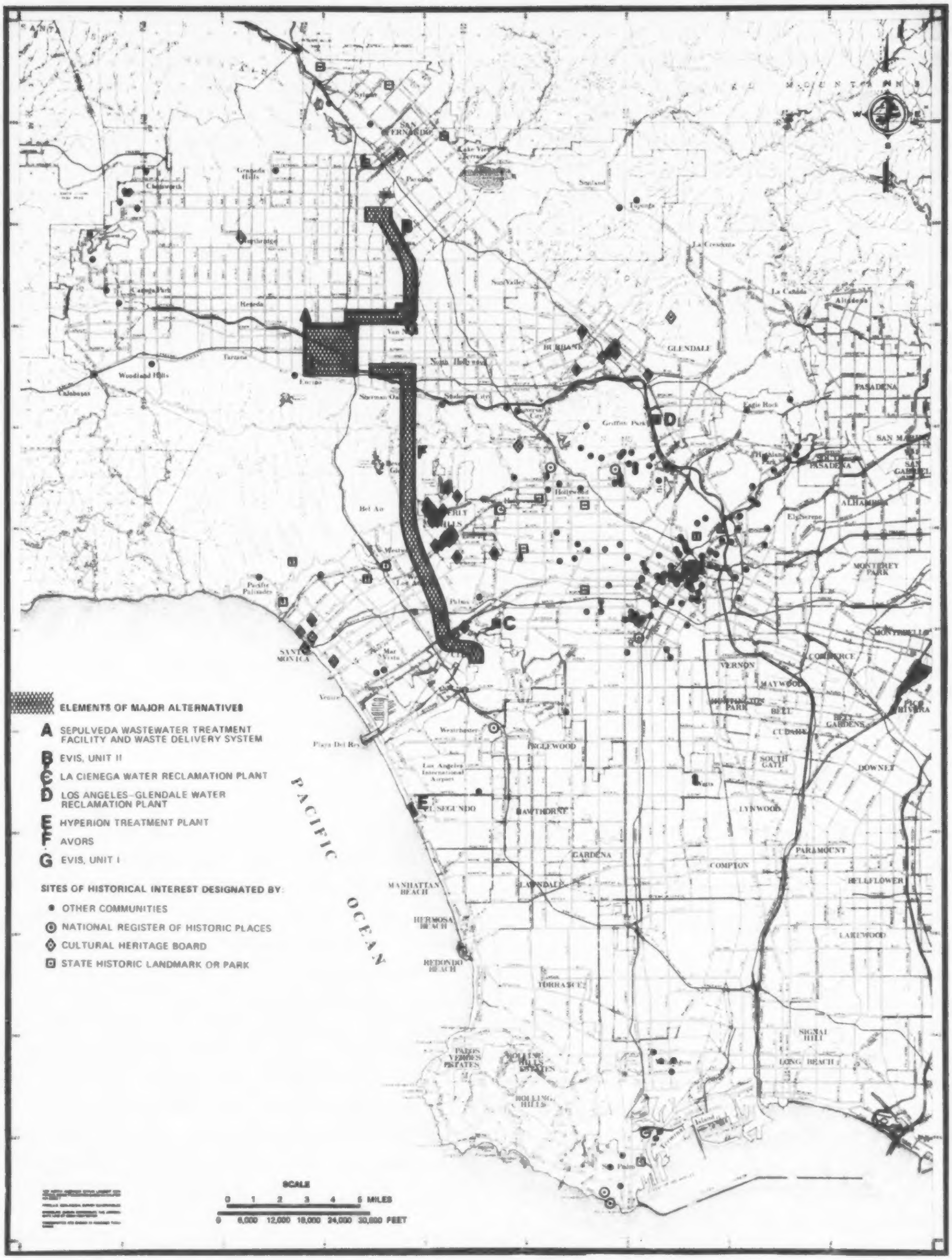
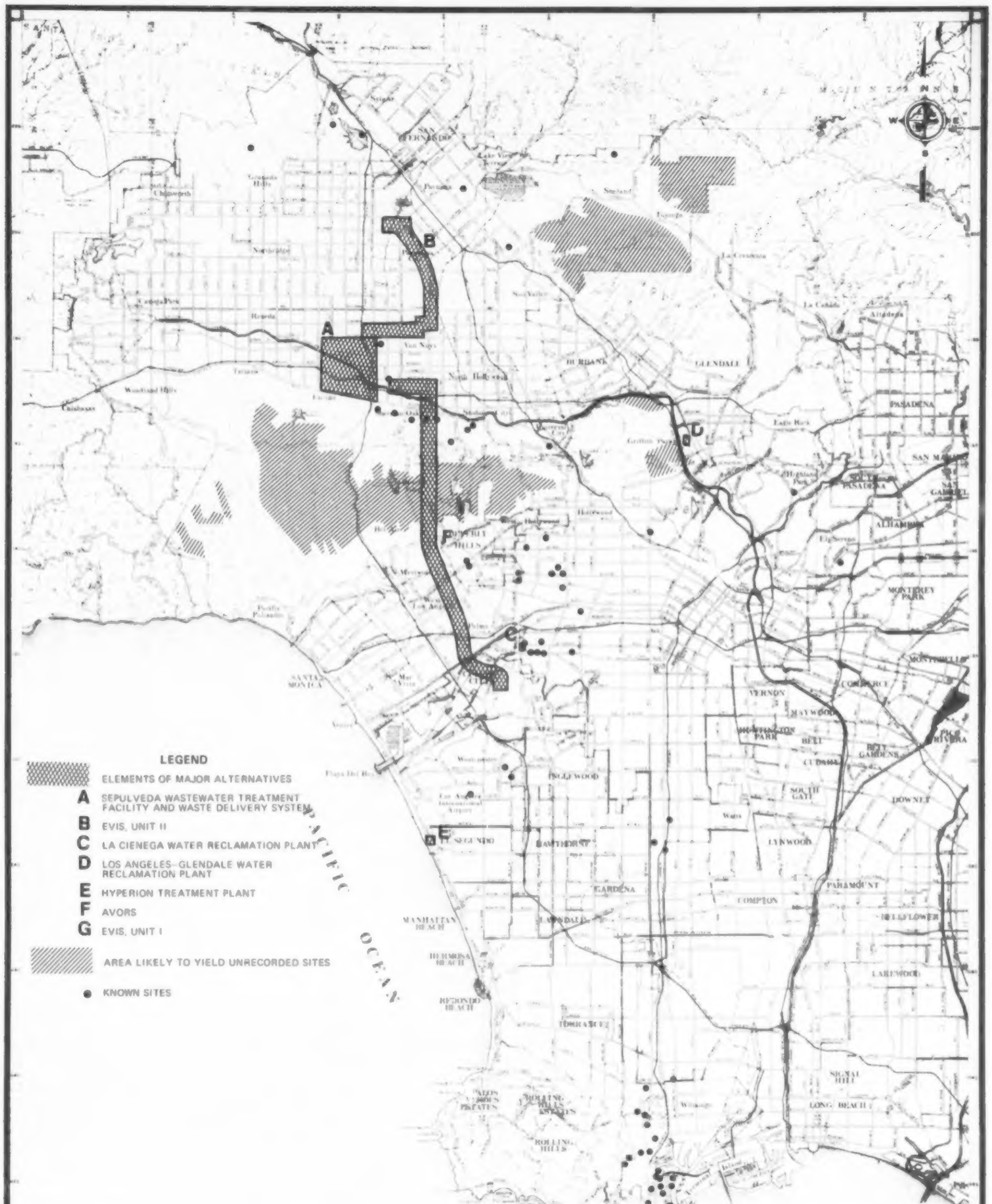

ELEMENTS OF MAJOR ALTERNATIVES
A SEPULVEDA WASTEWATER TREATMENT FACILITY AND WASTE DELIVERY SYSTEM
B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES–GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
SITES OF HISTORICAL INTEREST DESIGNATED BY:
● OTHER COMMUNITIES
◎ NATIONAL REGISTER OF HISTORIC PLACES
◈ CULTURAL HERITAGE BOARD
▣ STATE HISTORIC LANDMARK OR PARK
PACIFIC OCEAN
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
GLENDALE
BURBANK
PASADENA
SANTA MONICA
INGLEWOOD
COMPTON
LONG BEACH
TORRANCE
REDONDO BEACH
MANHATTAN BEACH
HERMOSA BEACH
EL SEGUNDO
GARDENA
LYNWOOD
DOWNEY
PARAMOUNT
BELLFLOWER
LAKEWOOD
VERNON
MONTEREY PARK
ALHAMBRA
SOUTH GATE
HAWTHORNE
ROLLING HILLS
PALOS VERDES ESTATES
SIGNAL HILL
198P-56

Figure II-6. Historical sites in the City of Los Angeles.


LEGEND
ELEMENTS OF MAJOR ALTERNATIVES
A SEPULVEDA WASTEWATER TREATMENT FACILITY AND WASTE DELIVERY SYSTEM
B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES–GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
AREA LIKELY TO YIELD UNRECORDED SITES
● KNOWN SITES
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
PACIFIC OCEAN
SANTA MONICA
BURBANK
GLENDALE
PASADENA
INGLEWOOD
COMPTON
LONG BEACH
A
B
C
D
E
F

198P-57

Figure II-7. Paleontological sites in the City of Los Angeles.

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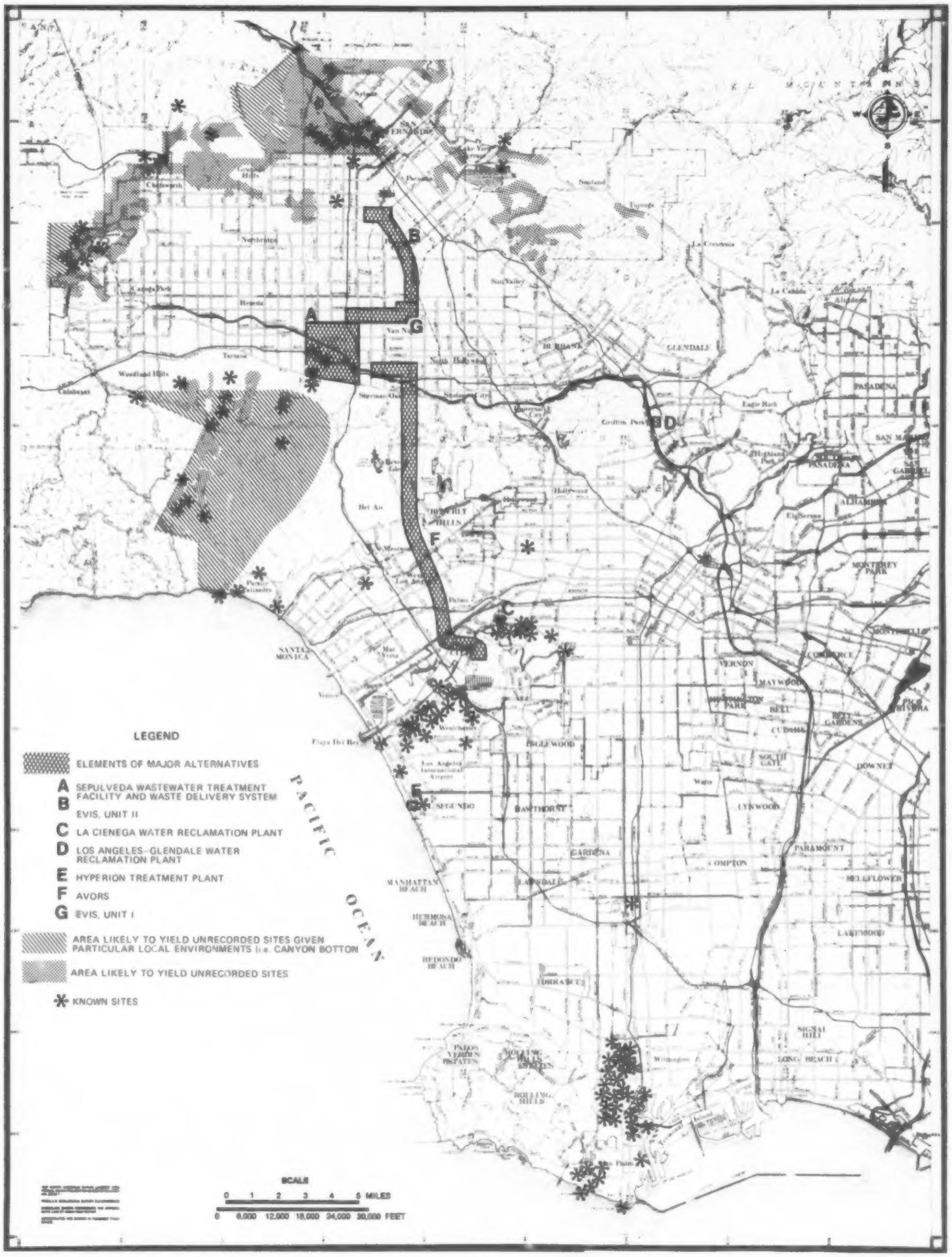
LEGEND
ELEMENTS OF MAJOR ALTERNATIVES
A SEPULVEDA WASTEWATER TREATMENT FACILITY AND WASTE DELIVERY SYSTEM
B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES-GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
AREA LIKELY TO YIELD UNRECORDED SITES GIVEN PARTICULAR LOCAL ENVIRONMENTS (i.e. CANYON BOTTON)
AREA LIKELY TO YIELD UNRECORDED SITES
KNOWN SITES
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
PACIFIC OCEAN
SANTA MONICA
BURBANK
GLENDALE
PASADENA
INGLEWOOD
HAWTHORNE
GARDENA
COMPTON
TORRANCE
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
VERNON
DOWNEY
LAKEWOOD
PARAMOUNT
BELLFLOWER
LYNWOOD
SOUTH GATE
ALHAMBRA
MONTEREY PARK
SIGNAL HILL
LONG BEACH

198P-58

Figure II-8. Archaeological sites in the City of Los Angeles.

a. Regional Historic Sites. Known cultural historical sites are scattered throughout Los Angeles and most of the seven contract cities which compose the service area. Most of these historical structures or areas are concentrated in a wide band from Santa Monica, through Beverly Hills, including downtown Los Angeles and northwest along the Pasadena Freeway towards South Pasadena. The remaining ones are clustered in or around San Pedro, and dispersed throughout the San Fernando Valley.

b. Historical Sites Within Project Proximity. Figure II-6 indicates the approximate locations of known historical sites and the seven major elements of projects discussed in the wastewater facilities plan: the Hyperion Treatment Plant in El Segundo, the Sepulveda Wastewater Treatment Plant north of the Ventura Freeway, the La Cienega Water Reclamation Plant south of Washington Boulevard, the AVORS tunnel alignment through the Santa Monica Mountains, the Los Angeles-Glendale Water Reclamation Plant south of Colorado Boulevard, and the two units of the East Valley Interceptor Sewer (EVIS I and II) along Woodman Avenue. A number of historical sites are located proximal to these proposed facilities or to their additions and will be discussed in detail here. These are only the known sites and may be indicative of other undesignated sites of potential historic or cultural interest.

Two sites are in close proximity to the projects proposed for the Sepulveda Dam Recreation area: Rancho El Encino in the Los Encinos State Historic Park at 16756 Moorpark Avenue; and an oak tree on Louise Avenue two hundred feet below the Ventura Freeway. Rancho El Encino is registered with both the National Register of Historic Places and the State Historic Parks, the oak tree is a Cultural Heritage Board landmark. In Culver City, two vestiges of the movie industry are proximal to the trench portion of the AVORS alignment. The Metro-Goldwyn-Mayer Studio gate at 10202 Washington Boulevard and the INCE/Culver City Studio building located at 9336 Washington Boulevard are both in the immediate trench vicinity. The gates were made an historically designated site in 1967, while the studio building, also known as the "Desilu Building," has been submitted for National registration consideration. Known historical sites are not apparent near other components of the proposed wastewater facilties; however, potential sites could exist.

c. Regional Archaeological and Paleontological Sites. Archaeological and paleontological sites also range across the areas serviced by the proposed facilities. Known archaeological sites are clustered around the coast of San Pedro, along the length of Ballona Creek, and on the Western perimeter of Los Angeles following the Santa Monica and Santa Susana Mountain ranges, shown in Figure II-7. Known fossil sites are clustered near the harbor, also north and east of Culver City, along the north slope of the Santa Monica Mountains, and across the top of the San Fernando Valley as shown in Figure II-7. Both potential archaeological and paleontological sites exist in large sections of the service area, but detailed assessments have not been carried out. These sections are centered in portions of the Santa Monica, Santa Susana and San Gabriel Mountain ranges that border the urbanized metropolis.

d. Specific Sites within Project Proximity. Specifics of the archaeological and paleontological sites can be obtained by contacting the District Clearinghouse of the UCLA Archaeological Survey and the Los Angeles County Natural History Museum. Identification of sites is made by number codes only of the known archaeological sites; six are located within two miles of the open trench section of the AVORS alignment. These are 4-LAn-55, 4-LAn-53, 4-LAn-56, 4-LAn-57, 4-LAn-58, and 4-LAn-68. No known sites are located proximal to the proposed AVORS tunnel project. Within two miles of the Hyperion Treatment Plant exist sites 4-LAn-204, 4-LAn-205, 4-LAn-206, 4-LAn-64, 4-LAn-65, 4-LAn-62, 4-LAn-211, 4-LAn-61, 4-LAn-212, and 4-LAn-9. This last site is within one quarter mile of the project area. The proposed La Cienega Water Reclamation Plant location is perhaps in the most archaeologically sensitive area of all the proposed facilities. Within five miles of the proposed facility are sites 4-LAn-204, 4-LAn-203, 4-LAn-206, 4-LAn-65, 4-LAn-64, 4-LAn-62, 4-LAn-211, 4-LAn-61, and 4-LAn-212, and many of these are within close proximity to the project site. Two sites are within two miles of the Sepulveda projects, 4-LAn-343 and 4-LAn-43. No known sites are apparent near the Los Angeles-Glendale addition nor in the vicinity of the EVIS I and II alignments.

Paleontological sites shown in Figure II-8 are known to be in the vicinity of the EVIS II alignment and the Sepulveda projects as well as in the area of the AVORS tunnel and the La Cienega facility. Paleontological sites 3822 and 3263 are close to both the Sepulveda Dam Recreation Area and to the AVORS tunnel where it approaches the Sepulveda facilities. Sites numbered 1408 and 7022 are proximal to the AVORS tunnel where it burrows through the Santa Monica Mountains. Although known sites have been recorded only on the north slope of these mountains, the south slope is considered to be an area likely to contain paleontological sites. The AVORS tunnel alignment passes through both areas. The proposed La Cienega facility is located in an area of numerous paleontological as well as archaeological sites. Those numbered 3368, 3367, and 3370 are the closest of several in the vicinity. The remaining proposed facilities or additions do not appear to be situated in close proximity to known sites.

C. physical environment

C. PHYSICAL ENVIRONMENT

1. GEOGRAPHY AND TOPOGRAPHY

The geomorphologic characteristics of the Los Angeles region influence both the development of wastewater facilities and the environmental impacts associated with them in a number of ways. Among these are:

1. Wastewater collection facilities are most economically developed when wastewater runs "downhill" from the collection point to the treatment plant. If gravity transport is not feasible, pumped "force mains" and holding tanks must generally be used, at greater initial expense, maintenance costs, and consumption of energy to operate the pumps.
2. Rugged topography (e.g., along the slope of hilly terrain) makes installation of wastewater collection systems more difficult than in flat terrain, and also leads to potential erosion and instability problems when such facilities are installed. Sewage collection systems running downhill or crossing under streams (except as "inverted siphons") may also be accompanied by increased erosion, or locally saturated zones. In this situation, water (e.g., from rain or runoff) may penetrate to the bottom of the ditch in which the collection pipe is installed, and move along it. The result can be increased erosion, or creation of locally saturated zones in unexpected (and unwanted) locations. However, this condition can be circumvented by suitable planning and design.
3. Topographic features control the types of microclimates that exist in various areas. These factors in turn influence air quality, water quality, and the associated biota.

Topographically and geographically, the Los Angeles Area can be subdivided into three major subregions:

1. The Los Angeles Coastal Plain
2. The Santa Monica Mountains
3. The San Fernando Valley

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a. The Coastal Plain. The Los Angeles Coastal Plain is a lowland area, broken by localized hilly areas, but otherwise sloping gently toward the sea. Parts of the Hyperion Service Area and the entire Terminal Island Service Area lie on this plain. To the north, the Coastal Plain is bounded by the Santa Monica Mountains (with Griffith Park at their eastern end), and by the Repetto and Puente Hills. To the east it is bounded by the Santa Ana Mountains and San Joaquin Hills, and to the south and west by the Palos Verdes Hills and the Pacific Ocean.

Much of this area is served by the Los Angeles County Sanitation Districts; the Hyperion Service Area lies within the area west of the Los Angeles River, in which the generally planar surface is broken by localized hills including Beverly Hills, Baldwin Hills, Dominguez Hills, and the Palos Verdes Hills. In this area, the plain ranges in elevation from sea level to approximately 500 feet at the Santa Monica Mountains to the North. Because of this slope, gravity flow of sewage is generally possible to the Hyperion Treatment Plant except for interceptors that follow the coastline to the north toward Santa Monica.

The part of the Coastal Plain of interest with respect to the Facilities Plan Environmental Assessment/Report is drained principally by three main watercourses. The Los Angeles River, which originates in the hills at the westernmost edge of the San Fernando Valley, enters the Coastal Plain at the Los Angeles Narrows (a gap between the Santa Monica Mountains and the Repetto Hills), and flows southward to Long Beach. Dominguez Channel drains the large low-lying southwest area from Gardena southward, and discharges into San Pedro Bay (near the Terminal Island Treatment Plant) via the Los Angeles Harbor. Ballona Creek drains the northwestern portion of the Coastal Plain and enters Santa Monica Bay near the main channel at Marina del Rey. All of these streams have been improved through application of concrete or rock ("riprap") linings to confine their courses and ensure adequate capacity in major storms. Minor unimproved streams further to the west drain directly into Santa Monica Bay.

Ballona Creek also provides an emergency outfall to the sea for chlorinated wastewater. This condition is related to the inability of the lower reach of the North Outfall Sewer (which is built from unreinforced concrete) to withstand internal pressures. During rainy weather, flows increase in the section of the NOS as the result of infiltration and inflow; an automatic diversion structure has therefore been provided that chlorinates part of the flow and diverts it to Ballona Creek to prevent damage to the NOS under high flow condition. This feature is described in more detail elsewhere in this EIS.

In addition to the hills mentioned above, one additional feature of the Coastal Plain is of interest. A coastal belt of sand dunes, known as the El Segundo Sand Hills, borders the shoreline of Santa Monica Bay and extends northward from Palos Verdes Hills for a distance of about 11 miles to Ballona Creek and inland from 3 to 4 miles. The crests of the hills rise to 185 feet above sea level. Both the Hyperion Treatment Plant and the Los Angeles International Airport lie within this dune area. On the airport property, the dunes provide habitat for the El Segundo Blue, an endangered species of butterfly, as discussed in more detail under the Biological Environment. The poorly to semi-consolidated sandy-subsurface also tends to retard seismic waves and thus accumulates energy. In event of a tremor, this condition can lead to increased ground shaking.

b. The Santa Monica Mountains. The Santa Monica Mountains form the northwestern boundary of the Coastal Plain, and the southern boundary of the San Fernando Valley. Structurally, they are related to the Repetto Hills to their west, but during the uplift that formed the mountains, the Los Angeles River and other stream systems from the Glendale area cut a gap at the Los Angeles Narrows, to give the present discontinuity between these two geographic features. The maximum elevation of the east-west trending Santa Monica Mountains is 2,126 feet, and slopes are moderate to steep. The eastern end of the Santa Monica Mountains is generally referred to as Griffith Park, which includes extensive recreational areas and facilities, including the Los Angeles Zoo with its separate treatment plant for animal wastes.

The most significant aspect of the Santa Monica Mountains with respect to wastewater treatment systems is the fact that they form a barrier to gravity flow of wastewater from the San Fernando Valley to the ocean. Were it not for the creation of the Los Angeles Narrows by the erosive action of the Los Angeles River, the Valley would presently be a closed basin without exterior drainage. This feature has influenced the development of the location of main interceptor sewers in the Hyperion Service Area—first by construction of the NOS system through the narrows and westward into the Valley, and later through construction of a tunnel through the mountains [part of the La Cienega-San Fernando Valley Relief (LCSFVR) interceptor] to provide a shorter and more economical route for wastewater from the Valley to the Hyperion Treatment Plant. This tunnel follows the approximate course of an earlier watergap formed by the Los Angeles River prior to assuming its present path through the Los Angeles Narrows.

c. San Fernando Valley. The San Fernando Valley lies north of the Santa Monica Mountains, and is bounded on the west and northwest by the Santa Susana Mountains, on the northeast by the San Gabriel Mountains, and on the east and southeast by the Verdugo and Repetto Hills. The Valley forms a semi-enclosed basin, approximately 23 miles in east-west and 12 miles in north-south dimensions.

Since the mountains to the north were formed by overthrusting and are considerably higher and more asymmetric than the Santa Monica Mountains to the south, they have contributed substantially more material to the Valley fill, which consequently slopes generally southward. The Valley is drained by the Los Angeles River, which flows eastward along its southern boundary and is fed by tributary streams that flow southward across the Valley floor and northward from the piedmont slopes of the Santa Monicas.

This topographic configuration has similarly influenced development of the wastewater collection system for the Valley. The major interceptors are at the southern edge of the Valley, and flow easterly either to the LCSFVR tunnel or to the NOS path through the Los Angeles Narrows to reach the Coastal Plain and thus the Hyperion Treatment Plant. (Some of the wastewater in the NOS is also treated at LAGWRP, at the Valley's southeast end.)

Both the existing Los Angeles-Glendale Water Reclamation Plant (LAGWRP) at the southeasternmost part of the Valley and the proposed Sepulveda Facility at the south-central Valley are adjacent to the Los Angeles River. The river has in part influenced selection of these plants, since it provides a conduit to the sea for treated wastewater that cannot be applied to consumptive beneficial uses (e.g., irrigation). Also (for the Sepulveda Facility), the river and its existing flood-control developmental aspects (e.g., concrete channel and riprap) provide a path to spreading grounds where, if approved by the California Department of Health, treated water could be used to recharge groundwater for ultimate general-purpose (potable) reuse.

2. GEOLOGY AND SEISMICITY

Geology and seismicity (types of structural relationships of rocks, earth shaking) influence the wastewater system in a number of ways, including:

1. Geologic conditions influence topography, with the consequences discussed in Section II-C.
2. The difficulty of excavation of various rock types may influence decisions as to the location of interceptors. (Ease of excavation results in lower costs, but harder, denser rocks give more favorable seismic response.)
3. The level of groundwater, as controlled by geologic conditions, can influence the degree of infiltration into wastewater collection systems. When pipes are installed in "wet" areas where they are permanently or periodically inundated in groundwater or seawater, water can enter the pipes, producing an additional flow known as "infiltration" that increases the load on the downstream treatment plant. This is currently a problem, for example, in the Coastal Interceptor Sewer (CIS).
4. Similarly, high groundwater levels can influence plant locational decision, since near-surface groundwater can both increase the amount of surface shaking during earthquakes, and increase the potential for "liquefaction." The latter is a phenomenon in

which fine-grained, noncohesive material loses its frictional resistance and mechanical strength and becomes a viscous liquid, potentially leading to the destruction of major facilities such as treatment plants.

5. Geological conditions influence the location and capacity of groundwater basins, which provide both sources and storage for water supplies. Availability of adequate water is essential for operation of a wastewater system, and both services are commonly, although not always, provided together.

6. The presence of active or potentially active faults (breaks in the earth's crust along which movements have occurred and may occur in the future) influences the probability of seismic shaking, or of actual breaks in the surface. They thus influence locational decisions for major plants, and are also taken into account in overall planning for future population distributions and consequent wastewater flows.

7. The type of rock that underlies a given location also influences the amount of shaking that will occur during an earthquake, and can influence locational decisions. In general, under otherwise equal conditions, the same earthquake event will produce less shaking on hard, dense, relatively strong rocks than it will on softer, poorly consolidated, weaker rocks. The presence of groundwater near the surface (commonly in the weaker rock types) also tends to increase the intensity of surface shaking. Some rocks are more susceptible to chemical decomposition of their mineral contents than others (e.g., basalt).

8. Underlying rock structures are also significant in the ways in which they can affect subsurface and surface conditions. For example, rock joints and fractures, cleavage and planes of schistosity influence rock mechanics. Features such as a homocline dipping out of a naturally eroded or man-cut slope, are open prey to landsliding conditions; synclines can contain local perched-water tables, and dikes/sills can serve as barricades to gravity flow of subsurface fluids.

9. When subsurface mineral resources (water, oil, and gas) are extracted from thick sections of interbedded rocks, the earth's surface may actually subside, causing cracks or breaks in wastewater collection systems. Such breaks can contribute to infiltration if they occur in regions where the pipes are inundated by groundwater, or to outflow or "exfiltration" with potential health hazards where they are not. This phenomenon has been a problem in the past in the Terminal Island Service Area, where past subsidence led to infiltration in damaged wastewater collection systems. Repair ("rebound") of the collapsed surface and elimination of future occurrence has been obtained, however, by recharging water into peripheral wells in the Wilmington subsurface fault-blocks.

a. Geology. The general geologic setting of the Los Angeles area is described below in brief, for the orientation of the reader. A more detailed summary is given in Appendix A, "Geology and Soils of the City of Los Angeles and Vicinity," of the Facilities Plan (DPW, 1976), to which the interested reader is referred.

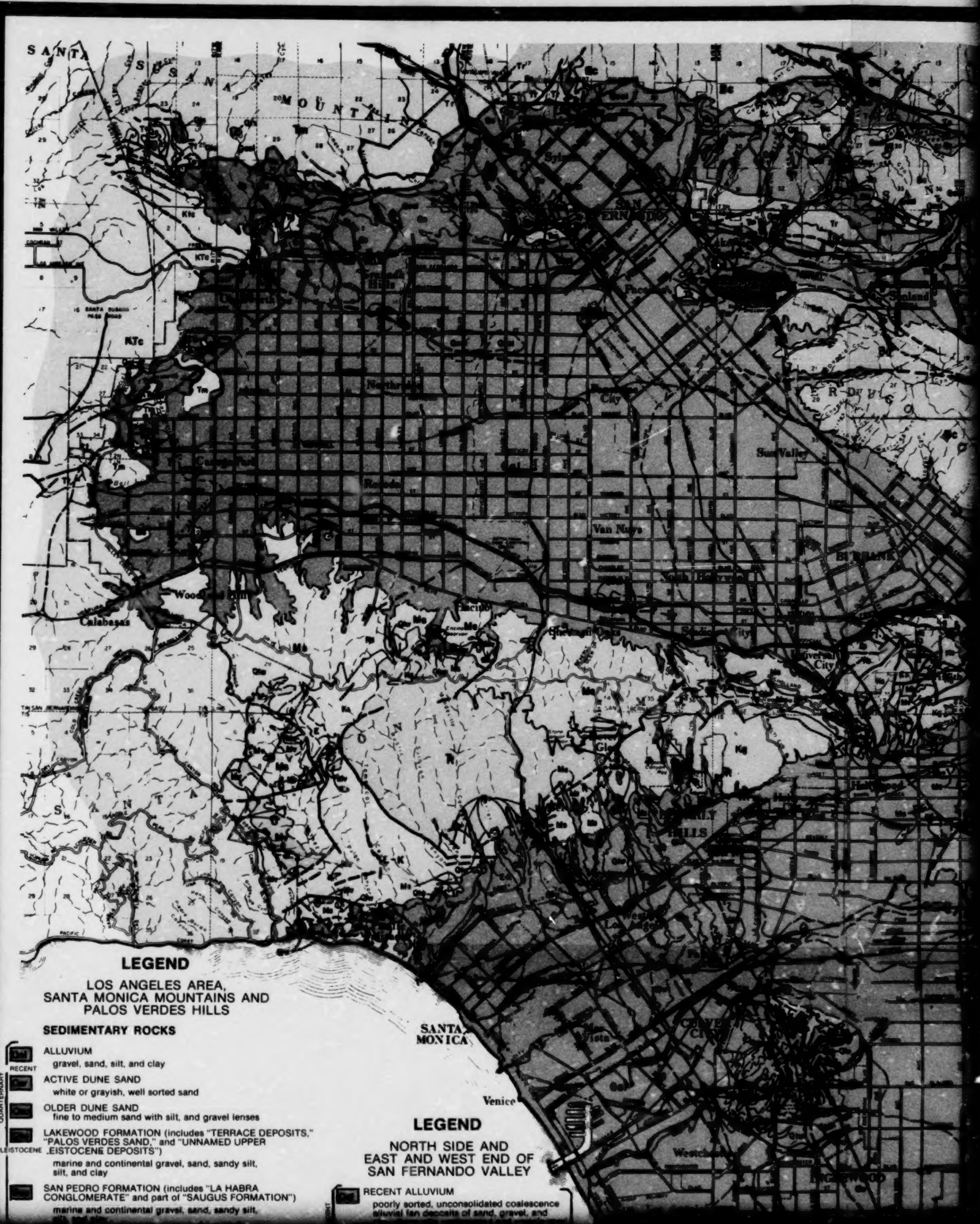
Figure II-9 is a geological map of the Los Angeles area. (The same map, but without the simplified color overlays, is given in Appendix A of the Facilities Plan, together with stratigraphic columns for the various geologic formations called out in the legend.) For simplicity, three generalized rock types have been shown on this map:

1. "Quaternary" deposits (sedimentary rocks generally less than one million years old), in blue. These rocks, because they are young geologically and poorly consolidated and indurated, are commonly weaker than the other types, and relatively easy to excavate. The major groundwater basins also occur in these rocks (principally those marked "Qal," which designate geologically recent alluvial deposits which are predominantly porous gravels, sands, silts, and clays through which groundwater can move relatively freely). They usually represent marine and/or alluvial terrace deposits.
2. Older sedimentary rocks (in green). These rocks were principally deposited on the ocean bottom during prior geological epochs during which the sea formed an embayment in the area, but in part also represent older deposits on land. In general, in the greater Los Angeles area, they are relatively easy to excavate. Note that much of the area colored in blue is underlain by such rocks, particularly on the Coastal Plain, where they form thick sections and have been prolific sources of oil and gas. These rocks may also be water bearing, but the water, (usually connate, or trapped when the sediments were deposited) is generally of poorer quality than that in the alluvium, and may be a source of contamination of the higher quality sources under some conditions.
3. Igneous and metamorphic rocks, in red. In contrast with the sedimentary rocks, which are derived by disintegration, transport, and deposition of other rocks, igneous rocks were once molten, and congealed into their present state. The metamorphic rocks were produced by pressure and/or heat acting on other rock types. These rocks tend to be hard and difficult to excavate. Except where they are extensively fractured, they are also poor sources of water.

The following generalizations may be made with respect to the three regions discussed under Geography and Topography, i.e., the Coastal Plain, the Santa Monica Mountains, and the San Fernando Valley.

(1) THE COASTAL PLAIN. As shown on the geologic map, the surface of the Coastal Plain is predominantly characterized by geologically young

A


SANTA SUSANA MOUNTAINS
SAN FERNANDO
Chatsworth
Northridge
Canoga Park
Reseda
Van Nuys
North Hollywood
BURBANK
Sun Valley
Sunland
VERDUGO
Woodland Hills
Calabasas
Encino
Sherman Oaks
Studio City
Universal City
Hollywood
BEVERLY HILLS
SANTA MONICA
Venice
CULVER CITY
Westchester
INGLEWOOD
PACIFIC COAST

LEGEND

LOS ANGELES AREA, SANTA MONICA MOUNTAINS AND PALOS VERDES HILLS

SEDIMENTARY ROCKS

QUARTERNARY

RECENT

ALLUVIUM
gravel, sand, silt, and clay

ACTIVE DUNE SAND
white or grayish, well sorted sand

OLDER DUNE SAND
fine to medium sand with silt, and gravel lenses

PLEISTOCENE

LAKEWOOD FORMATION (includes "TERRACE DEPOSITS," "PALOS VERDES SAND," and "UNNAMED UPPER .EISTOCENE DEPOSITS")
marine and continental gravel, sand, sandy silt, silt, and clay

SAN PEDRO FORMATION (includes "LA HABRA CONGLOMERATE" and part of "SAUGUS FORMATION")
marine and continental gravel, sand, sandy silt,

LEGEND

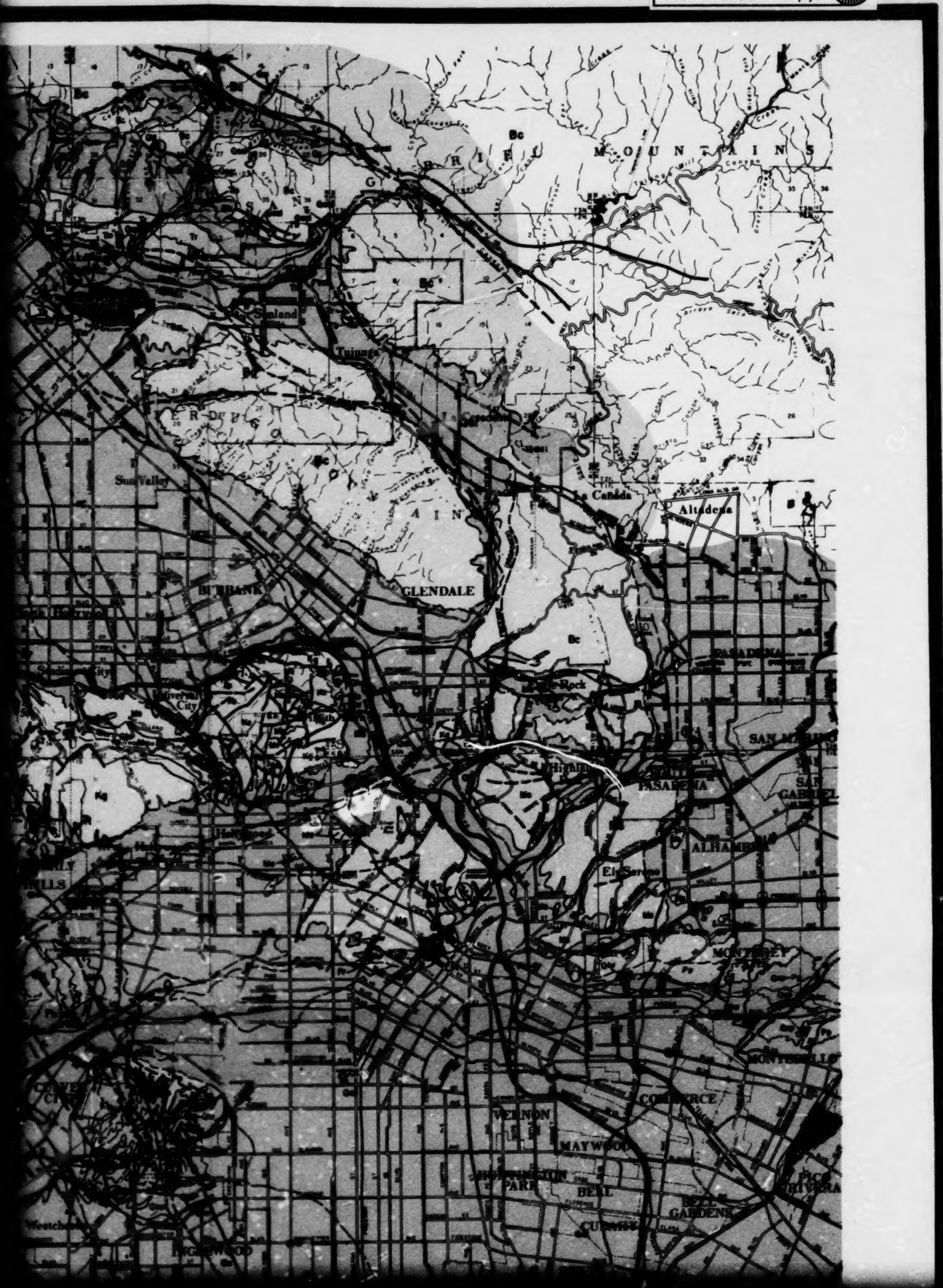
NORTH SIDE AND EAST AND WEST END OF SAN FERNANDO VALLEY

RECENT ALLUVIUM
poorly sorted, unconsolidated coalescence alluvial fan deposits of sand, gravel, and

1

B

Reproduced from
best available copy.


SAN GABRIEL MOUNTAINS
Bc
Sunland
Tujunga
VERDUGO MOUNTAINS
Sun Valley
La Canada
Altadena
BURBANK
GLENDALE
PASADENA
Eagle Rock
SAN MARINO
Highland Park
SOUTH PASADENA
SAN GABRIEL
ALHAMBRA
El Sereno
MONTEREY PARK
Studio City
Universal City
Hollywood
BEVERLY HILLS
Kg
MONTEBELLO
COMMERCE
CULVER CITY
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY
PICO RIVERA
Westchester
INGLEWOOD

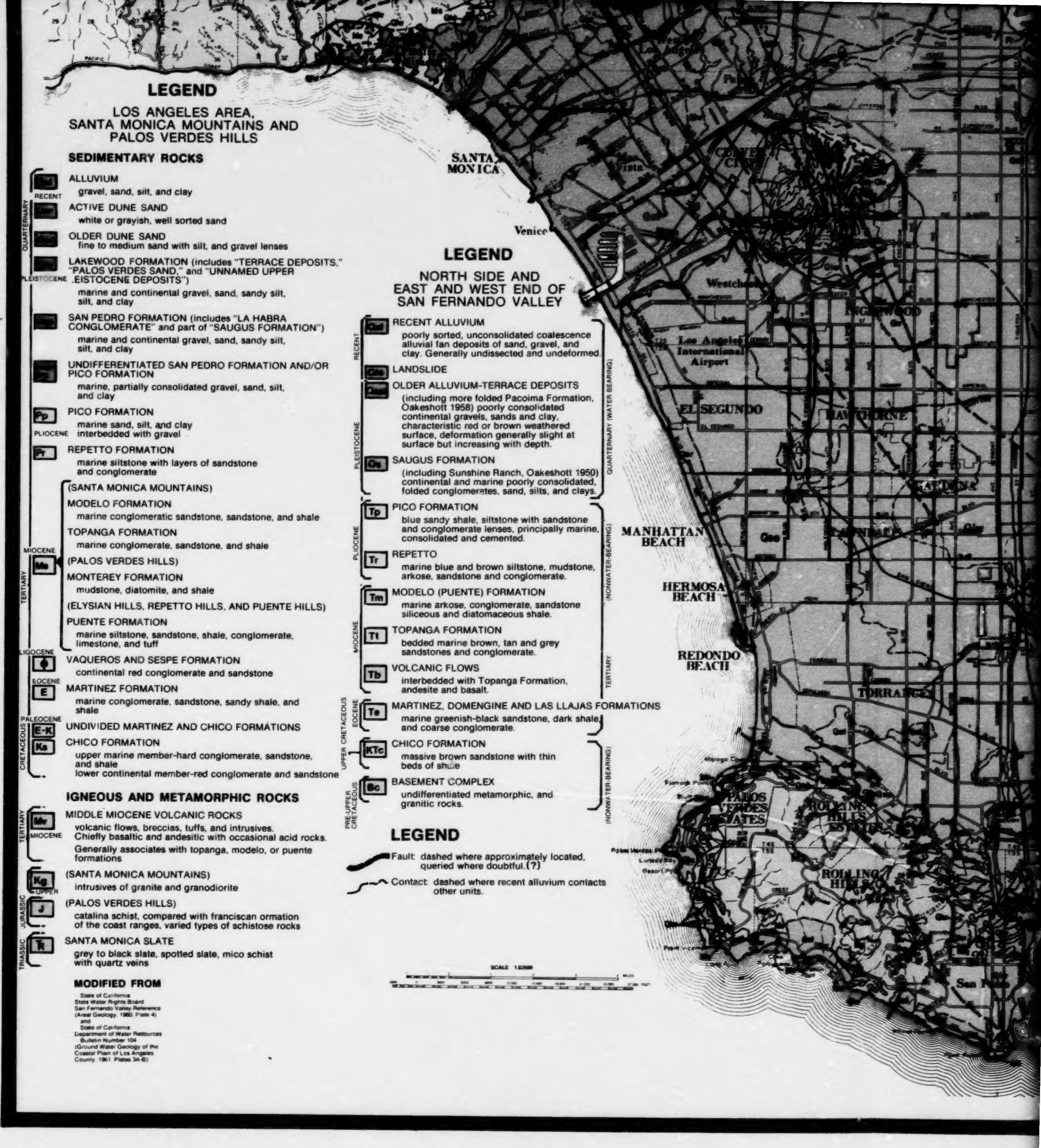
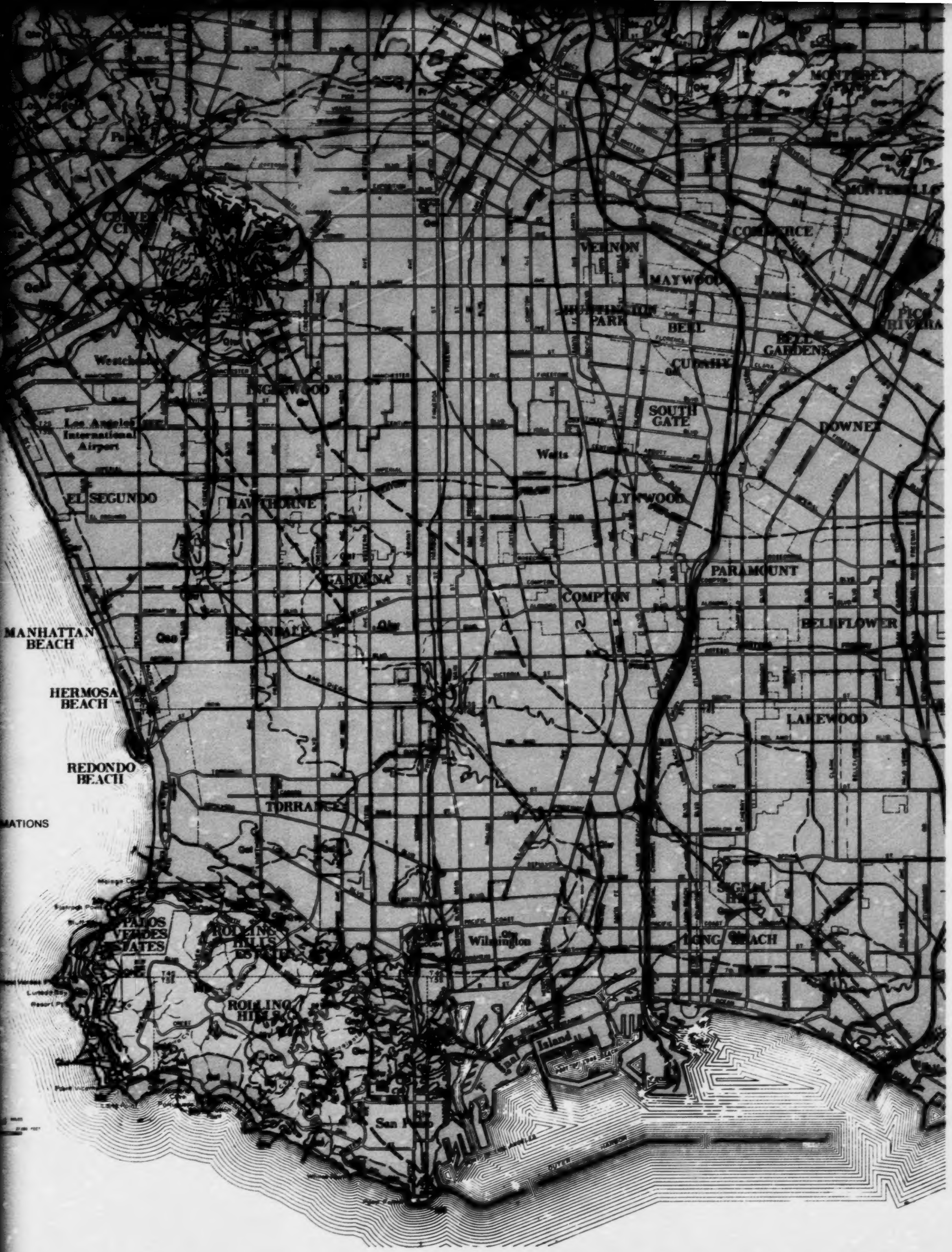

LEGEND
LOS ANGELES AREA, SANTA MONICA MOUNTAINS AND PALOS VERDES HILLS
SEDIMENTARY ROCKS
QUATERNARY
RECENT
ALLUVIUM
gravel, sand, silt, and clay
ACTIVE DUNE SAND
white or grayish, well sorted sand
OLDER DUNE SAND
fine to medium sand with silt, and gravel lenses
PLEISTOCENE
LAKEWOOD FORMATION (includes "TERRACE DEPOSITS," "PALOS VERDES SAND," and "UNNAMED UPPER PLEISTOCENE DEPOSITS")
marine and continental gravel, sand, sandy silt, silt, and clay
SAN PEDRO FORMATION (includes "LA HABRA CONGLOMERATE" and part of "SAUGUS FORMATION")
marine and continental gravel, sand, sandy silt, silt, and clay
UNDIFFERENTIATED SAN PEDRO FORMATION AND/OR PICO FORMATION
marine, partially consolidated gravel, sand, silt, and clay
Pp
PICO FORMATION
marine sand, silt, and clay interbedded with gravel
PLIOCENE
Pr
REPETTO FORMATION
marine siltstone with layers of sandstone and conglomerate
TERTIARY
MIOCENE
Mo
(SANTA MONICA MOUNTAINS)
MODELO FORMATION
marine conglomeratic sandstone, sandstone, and shale
TOPANGA FORMATION
marine conglomerate, sandstone, and shale
(PALOS VERDES HILLS)
MONTEREY FORMATION
mudstone, diatomite, and shale
(ELYSIAN HILLS, REPETTO HILLS, AND PUENTE HILLS)
PUENTE FORMATION
marine siltstone, sandstone, shale, conglomerate, limestone, and tuff
OLIGOCENE
VAQUEROS AND SESPE FORMATION
continental red conglomerate and sandstone
EOCENE
E
MARTINEZ FORMATION
marine conglomerate, sandstone, sandy shale, and shale
PALEOCENE
E-K
UNDIVIDED MARTINEZ AND CHICO FORMATIONS
CRETACEOUS
Ks
CHICO FORMATION
upper marine member-hard conglomerate, sandstone, and shale
lower continental member-red conglomerate and sandstone
IGNEOUS AND METAMORPHIC ROCKS
TERTIARY
MIOCENE
Mv
MIDDLE MIOCENE VOLCANIC ROCKS
volcanic flows, breccias, tuffs, and intrusives. Chiefly basaltic and andesitic with occasional acid rocks.
Generally associates with topanga, modelo, or puente formations
UPPER
Kg
(SANTA MONICA MOUNTAINS)
intrusives of granite and granodiorite
JURASSIC
J
(PALOS VERDES HILLS)
catalina schist, compared with franciscan ormation of the coast ranges, varied types of schistose rocks
TRIASSIC
Tr
SANTA MONICA SLATE
grey to black slate, spotted slate, mico schist with quartz veins
MODIFIED FROM
State of California
State Water Rights Board
San Fernando Valley Reference
(Areal Geology, 1960, Plate 4)
and
State of California
Department of Water Resources
Bulletin Number 104
(Ground Water Geology of the Coastal Plain of Los Angeles County, 1961, Plates 3A-B)
LEGEND
NORTH SIDE AND EAST AND WEST END OF SAN FERNANDO VALLEY
RECENT
Qal
RECENT ALLUVIUM
poorly sorted, unconsolidated coalescence alluvial fan deposits of sand, gravel, and clay. Generally undissected and undeformed.
Qls
LANDSLIDE
PLEISTOCENE
Qoal
OLDER ALLUVIUM-TERRACE DEPOSITS
(including more folded Pacoima Formation, Oakeshott 1958) poorly consolidated continental gravels, sands and clay, characteristic red or brown weathered surface, deformation generally slight at surface but increasing with depth.
Qs
SAUGUS FORMATION
(including Sunshine Ranch, Oakeshott 1950) continental and marine poorly consolidated, folded conglomerates, sand, silts, and clays.
QUATERNARY (WATER BEARING)
PLIOCENE
Tp
PICO FORMATION
blue sandy shale, siltstone with sandstone and conglomerate lenses, principally marine, consolidated and cemented.
Tr
REPETTO
marine blue and brown siltstone, mudstone, arkose, sandstone and conglomerate.
MIOCENE
Tm
MODELO (PUENTE) FORMATION
marine arkose, conglomerate, sandstone siliceous and diatomaceous shale.
Tt
TOPANGA FORMATION
bedded marine brown, tan and grey sandstones and conglomerate.
Tb
VOLCANIC FLOWS
interbedded with Topanga Formation, andesite and basalt.
(NONWATER-BEARING)
TERTIARY
EOCENE
Te
MARTINEZ, DOMENGINE AND LAS LLAJAS FORMATIONS
marine greenish-black sandstone, dark shale and coarse conglomerate.
UPPER CRETACEOUS
KTc
CHICO FORMATION
massive brown sandstone with thin beds of shale
PRE-UPPER CRETACEOUS
Bc
BASEMENT COMPLEX
undifferentiated metamorphic, and granitic rocks.
(NONWATER-BEARING)
LEGEND
Fault dashed where approximately located, queried where doubtful.(?)
Contact dashed where recent alluvium contacts other units.
SCALE 1:62500
SANTA MONICA
Venice
Westchester
Los Angeles International Airport
INGLEWOOD
EL SEGUNDO
HAWTHORNE
GARDENA
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
San Pedro

Figure II-9. Geology of the Los Angele[illegible] [illegible]egion
(City of Los Angeles, 1975).

C


MONTEREY PARK
MONTEBELLO
CULVER CITY
COMMERCE
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
PICO RIVERA
BELL GARDENS
CUDAHY
Westchester
INGLEWOOD
SOUTH GATE
DOWNEY
Los Angeles International Airport
Watts
EL SEGUNDO
HAWTHORNE
LYNWOOD
PARAMOUNT
GARDENA
COMPTON
MANHATTAN BEACH
LAWNDALE
BELLFLOWER
HERMOSA BEACH
LAKEWOOD
REDONDO BEACH
TORRANCE
MATIONS
SIGNAL HILL
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
Wilmington
LONG BEACH
ROLLING HILLS
Island
San Pedro

198P-75

4 P.

on

D

deposits, with outcroppings of older sedimentary rocks in the hilly areas and minor outcroppings of volcanic rocks in the Palos Verdes Hills. These surface deposits contain substantial supplies of groundwater, which tend to be "recharged" in the northern areas, and move underground toward the sea. Prior to extensive pumping of this groundwater, the seaward movement was unimpeded, and freshwater ultimately reached the sea. However, extraction of the groundwater has created a situation in which the natural seaward flow is reversed near the coast, so that the denser seawater at higher levels tends to flow inland, potentially contaminating water wells. To counteract this underflow wedging tendency, freshwater is injected into the water-bearing formations at several locations along the coast, forming subsurface freshwater "hills" to impede the onshore flow of seawater and prevent further contamination of existing wells. Imported water is currently being used for injection; reclaimed wastewater is a potential substitute.

Beneath the younger rocks on the Coastal Plain are thick sections of older sedimentary rocks, forming a complex synclinal structure trending generally northwest-southeast. [A "syncline" is a structure in layered rocks formed by their bending into a generalized "U" shape; an anticline is an upward bending, producing an inverted "U." The trend of the syncline is the direction of the trough at the bottom (or top) of the U.] The total thickness of sedimentary rocks in the Coastal Plain approaches 40,000 feet in the vicinity of South Gate and Downey (near the junction of the Rio Hondo and the Los Angeles River). Other anticlinal and synclinal structures are present on the limbs of this syncline, and it is also broken by tectonic faults.

It is because of the extraction of fluids (gas, oil, and water) from these thick sedimentary deposits that surface subsidence has occurred in the Terminal Island Service Area, affecting the wastewater collection system. Further details on the subsurface geology of the Coastal Plain are not pertinent to this EIS.

(2) SANTA MONICA MOUNTAINS. The Santa Monica Mountains are an east-west trending, structurally complex range related to the Transverse Range to the west. Structurally, they form a complex anticline, which has been uplifted along the Malibu-Santa Monica-Hollywood fault to their south, and which also has transverse faults with considerable displacement. The sedimentary rocks exposed at the surface are predominantly of the "older" (green) series shown on the geologic map. (The oldest of the sedimentary rocks are of the late Cretaceous period, and are not "old" in the geologic sense. The Cretaceous period began approximately 136 million years ago, and ended approximately 65 million years ago, whereas the age of the earth is estimated at 4.5 billion years.)

Minor outcroppings of volcanic rocks appear in the western part of the mountains, and metamorphic slate is extensively exposed in the central portion. A massive intrusion of granitic rock is present in the southeast central portion of the range, just north of West Hollywood

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and westerly of the LCSFVR tunnel. Other outcroppings occur at the eastern end of the range. These rocks may be relatively difficult to excavate, although they offer better free-standing capabilities than do the sedimentaries and often do not require costly shoring. Also, they respond more favorably to seismic shocks.

As noted previously, the Santa Monica Mountains form a barrier to wastewater flow southward toward the Hyperion Treatment Plant, so that tunnels must either be drilled through them, or the interceptors must be run to the Los Angeles Narrows at their eastern end. The north-south dimension of the mountains increases from east to west: any tunnelling operation at a more western point would thus represent a major undertaking.

(3) SAN FERNANDO VALLEY. As with the Coastal Plain, the uppermost rocks of the San Fernando Valley are alluvial materials that form an important groundwater basin with a maximum thickness of approximately 1,500 feet. The quality of groundwater in the western part of the basin has been degraded in the past through mixing with poorer-quality water carried by the Modelo formation (shown as Tm in the small, green-shaded outcroppings at the western end of the Valley on the geologic map).

Beneath the alluvial deposits is an east-west trending synclinal structure that has been complicated by faulting. The total maximum thickness of sedimentary rocks underlying the Valley is likely in excess of 14,000 feet.

b. Earthquake and Stability Parameters.

The geological environment in and around the City of Los Angeles will continue to subject the City to intense ground shaking in the event of a moderate or major local earthquake. An earthquake is caused when the accumulation of strain and strain energy along a fault in the earth's crust exceeds the elastic strength of the rocks. A sudden rupture occurs, releasing the stored energy and creating vibration waves that spread from the earthquake focus, or the point of initial rupture. These phenomena can cause permanent damage to man and his structures.

The 1933 Long Beach earthquake and the 1971-Sylmar shock awakened people to the realization that the Los Angeles Basin and the San Fernando Valley are not immune to the seismic hazards that characterize the San Andreas fault zone.

There are three basic earth-material failure mechanisms associated with an earthquake: shaking, breaking, and water-damage (Department of City Planning, 1975). The majority of structural failure caused by earthquakes results from:

- Shaking which damages the structure directly by vertical, lateral, and diagonal movements.
- Shaking which causes soil failure beneath the foundation of a structure by disruption of intergranular bond and cohesion.

- Shaking which causes the soil beneath the foundation to densify, shear, and settle, thus causing the structure to fail.

Breaking of the earth can be caused by four different processes:

- Compressional, tensional or rotational faulting resulting from displacement of two opposing blocks or portions of the earth along the fault line.
- Lurching, or the surface cracking and rupturing of soils at places other than directly along faults, caused by the inability of large masses of unconsolidated soils to support shaking accelerations.
- Liquefaction, which occurs when the shaking action causes saturated soils to lose their strength.
- Slope failure, from the shaking action resulting in landslides because coefficients of internal friction are thereby overcome by gravity forces.

Water damage can be caused by the rupture of dams or reservoirs, with resultant flooding (often sudden and violent) of downstream locations. It can also be caused by sloshing of water in lakes and reservoirs (seiches), or by seismic sea waves (tsunamis).

The amount of energy released by an earthquake has commonly been measured by the Richter scale. This scale was based on a value of 9 for the energy released from the largest physically possible earthquake. A difference of 1 on the scale corresponds to a difference in energy release of approximately 32: that is, an earthquake of magnitude 6 represents an energy release approximately 32 times larger than that of one of magnitude 5. Table II-4 relates magnitudes to approximate equivalents in TNT explosive values. The Hiroshima atom bomb released an energy equivalent of approximately 20,000 tons of TNT, or an equivalent magnitude of roughly 6.4).

The amount of shaking caused by an earthquake is commonly measured by the modified Mercalli Scale (Table II-5). This scale is subjective rather than instrumental, and the measurements are based on perceived motions or observed damage. Significantly different ratings on the Mercalli Scale may be experienced in geographically close locations during the same earthquake, depending on local geological conditions—say, with one location on dense bedrock, the other on deep, loose alluvial fill. Mercalli ratings of earthquakes are thus often given in terms of the highest value observed.

Peak accelerations in an earthquake accelerogram are followed by a series of high accelerations (termed "RHGA"), typically repeated. These secondary highs are considerably higher than the rest of the record but significantly less than the maximum. The factors which control RHGA are

Table II-4. Equivalent TNT energy of earthquakes.*

EARTHQUAKE MAGNITUDE (Richter Scale)	APPROXIMATE EARTHQUAKE ENERGY (EQUIVALENT WEIGHT OF TNT)
1.0	6 ounces
1.5	2 pounds
2.0	13 pounds
2.5	63 pounds
3.0	397 pounds
3.5	1,990 pounds
4.0	6 tons
4.5	32 tons
5.0	199 tons
5.5	1,000 tons
6.0	6,270 tons
6.5	31,550 tons
7.0	199,000 tons
7.5	1,000,000 tons
8.0	6,270,000 tons
8.5	31,550,000 tons
9.0	199,000,000 tons

*From Wiggins, 1974.

apparently the same as those which control peak acceleration, such as: (1) distance to epicenter and fault surfaces, (2) rock types and structures at the accelerograph recording site, (3) earth material in the travel path of seismic waves, (4) amount of energy (magnitude of the earthquake), (5) water-table and liquefaction possibilities, and (6) other lesser factors. Available data indicate that the RHGA averages about 65 percent of the peak (maximum) ground acceleration for sites within approximately 20 miles of the epicenter. Thus, while the maximum ground acceleration is an important part of a geological/seismic study, repeated earthquake movement reflected in RHGA quantification can, in certain instances, result in even more damaging results (Page et al., 1972; Schabel and Seed, 1973; Ploessel et al., 1974).

In the past, major earthquakes occurring in this area produced loss of life and property damage. Table II-6 summarizes the history of major earthquakes in Southern California. The most recent such earthquake was the San Fernando earthquake of 1971. Additional earthquakes will certainly occur.

The potential for earthquake shaking in Southern California has been intensely studied, and it is possible to identify the major potential earthquake producing faults and to estimate the resulting intensity of

Table II-5. The modified Mercalli Intensity Scale.*

INTENSITY	EFFECTS
I	Not felt except under especially favorable circumstances.
II	Felt by persons at rest, on upper floors, or favorably placed.
III	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. May not be recognized as an earthquake.
IV	Hanging objects swing. Vibration like passing of heavy trucks or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. Wooden walls and frames creak.
V	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move.
VI	Felt by all. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken visibly, or heard to rustle.
VII	Difficult to stand. Noticed by drivers of automobiles. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, also unbraced parapets and architectural ornaments. Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII	Steering of automobiles affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in floor or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated area sand and mud ejected, earthquake foundations, and craters.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	Rails bent greatly. Underground pipelines completely out of service.

*From Wiggins, 1974.

shaking for sites in this area. Figure II-10 shows the most dominant faults within the study area known to have been active during the Quaternary period. Table II-7 presents estimates of the magnitude of potential earthquakes along these faults. These estimates are commonly used for planning purposes. Maximum probable earthquake intensities are useful for structural design in non-emergency structures. Emergency structures may require a design based on the maximum credible earthquake.

The entire Basin area has been shaken on numerous occasions by externally generated earthquakes, two of which (Long Beach, 1933, and San Fernando, 1971) were close enough and of sufficient magnitude to have a potential for causing damage at a distance from the epicenter.

Table II-6. Major earthquakes in California from 1915 to 1971 (Townley and Allen, 1939; Wood and Heck, 1961).

DATE	TIME (PST)	LATITUDE	LONGITUDE	MAGNITUDE	INTENSITY	FELT AREA (Sq. Mi.)	LOCATION
22 Jun 1915	20:56	32.8	115.5	6.25	VIII	50,000 100,000	Imperial Valley
20 Nov 1915	16:14	32	115	7.1	VII	120,000	Colorado Delta
22 Oct 1916	18:44	34.9	118.9	6	VII	25,000 50,000	Tejon Pass
21 Apr 1918	14:32	33.7	117	6.8	IX	130,000	San Jacinto
22 Jul 1923	23:30	34	117.2	6.25	VII	70,000	San Bernardino
29 Jun 1925	06:42	34.3	119.8	6.3	VIII-IX	-	Santa Barbara
17 Sep 1927	18:07	37.5	118.7	6	VII	75,000	Bishop
10 Mar 1933	17:54	33.6	118.0	6.3	IX	100,000	Long Beach
30 Dec 1934	05:52	32.2	115.5	6.5	IX	60,000	Colorado Delta
31 Dec 1934	10:45	32	114.7	7.1	X	80,000	Colorado Delta
24 Feb 1935	-	32.0	115.2	6.0	-	-	Colorado Delta
25 Mar 1937	08:49	33.5	116.6	6.0	VII	30,000	Terwilliger Valley
18 May 1940	20:36	32.7	115.5	7.1	X	60,000+	Imperial Valley
8 Dec 1940	-	31.7	115.1	6.0	-	-	Colorado Delta
30 Jun 1941	23:51	34.4	119.6	6.0	VIII	20,000	Santa Barbara
21 Oct 1942	08:22	33.0	116.0	6.5	VII	35,000	Borrego Valley
15 Mar 1946	05:49	35.7	118.1	6.3	VIII	65,000	Walker Pass
10 Apr 1947	07:58	35.0	116.6	6.2	VII	75,000	Manix
4 Dec 1948	15:43	39.9	116.4	6.5	VII	65,000	Desert Hot Springs
21 Jul 1952	03:52	35.0	119.0	7.7	XI	160,000	Kern County
22 Jul 1952	23:53	35.0	118.8	6.4	VII	-	Kern County
23 Jul 1952	05:17	35.2	118.8	6.1	VII	-	Kern County
28 Jul 1952	23:03	35.4	118.9	6.1	VII	-	Kern County
19 Mar 1954	01:54	33.3	116.2	6.2	VI	40,000	Santa Rosa Mountains
24 Oct 1954	-	31.5	116.0	6.0	-	-	Aqua Blanca
12 Nov 1954	04:26	31.5	116	6.3	V+	-	Aqua Blanca
9 Feb 1956	06:32	31.8	115.9	6.8	VI+	30,000+	San Miguel
9 Feb 1956	-	31.7	115.9	6.1	-	-	San Miguel
14 Feb 1956	10:33	31.5	115.9	6.3	V+	-	San Miguel
14 Feb 1956	17:20	31.5	115.9	6.4	V+	-	San Miguel
7 Aug 1966	09:36	31.8	114.5	6.3	VI	-	Gulf, California
8 Apr 1968	18:29	33.1	116.1	6.5	-	-	Borrego Mountains
9 Feb 1971	06:01	34.4	118.4	6.5	XI	80,000	San Fernando

Although it is not currently feasible to establish precisely *when* an earthquake will occur, there is sufficient data for some fault systems to determine the approximate intervals between events of a given magnitude. This data is given as "recurrence intervals" for earthquakes of a given magnitude on a given system. Table II-8 provides data for selected systems that are potentially important with respect to the Los Angeles area.

A knowledge of areal seismicity is important in wastewater facilities planning so that the major structures, feeder lines, and outfalls are designed to withstand the credible levels of shaking, and so that extensions of service do not draw populations into areas of high seismic risk.

Additional details on the geology and seismicity of existing and proposed treatment plant sites are provided in the following section. None of the four sites is vulnerable to landslides and mudflows, or to

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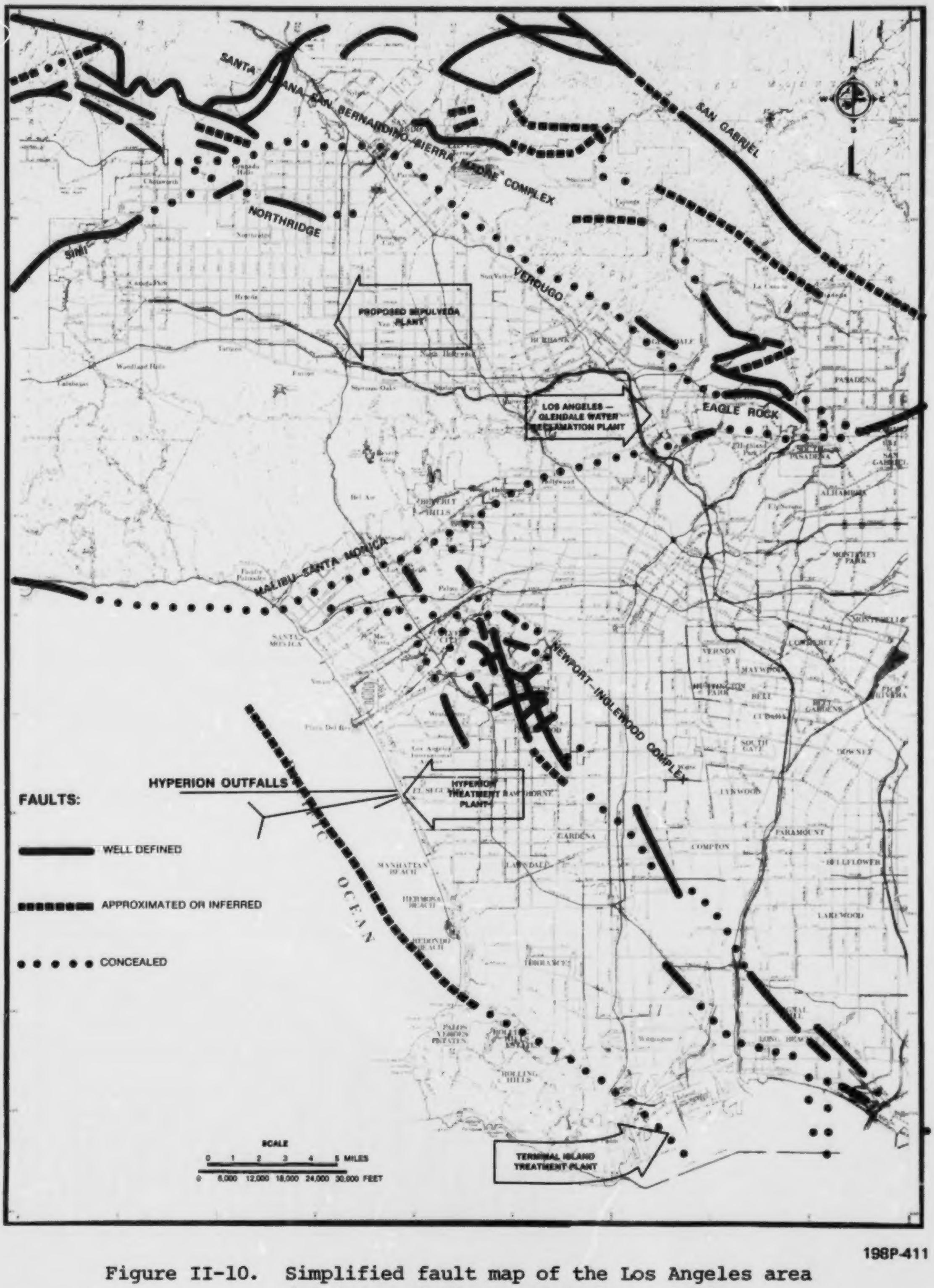

SANTA SUSANA-SAN BERNARDINO-SIERRA MADRE COMPLEX
SAN GABRIEL
NORTHRIDGE
SIMI
VERDUGO
PROPOSED SEPULVEDA PLANT
LOS ANGELES — GLENDALE WATER RECLAMATION PLANT
EAGLE ROCK
MALIBU-SANTA MONICA
NEWPORT-INGLEWOOD COMPLEX
HYPERION OUTFALLS
HYPERION TREATMENT PLANT
TERMINAL ISLAND TREATMENT PLANT
OCEAN
FAULTS:
WELL DEFINED
APPROXIMATED OR INFERRED
CONCEALED
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
BURBANK
GLENDALE
PASADENA
ALHAMBRA
MONTEREY PARK
SANTA MONICA
VERNON
HUNTINGTON PARK
BELL
SOUTH GATE
LYNWOOD
COMPTON
PARAMOUNT
BELLFLOWER
LAKEWOOD
DOWNEY
GARDENA
HAWTHORNE
EL SEGUNDO
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
ROLLING HILLS
PALOS VERDES ESTATES
LONG BEACH
BEVERLY HILLS

198P-411

Figure II-10. Simplified fault map of the Los Angeles area (Division of Mines and Geology, 1976).

Table II-7. Active and potentially active faults that could affect the City of Los Angeles (Wiggins, 1974; Bonilla & Buchanan, 1970).

FAULT	ACTIVE LENGTH OF FAULT AND ASSOCIATED FAULT SYSTEM (IN MILES)	MAXIMUM CREDIBLE EARTHQUAKE (FAULT RUPTURE = 1/2 ACTIVE FAULT LENGTH) (MAGNITUDE)	MAXIMUM PROBABLE EARTHQUAKE IN NEXT 100 YEARS (FAULT RUPTURE = 1/10 ACTIVE FAULT LENGTH) (MAGNITUDE)	MINIMUM DISTANCE OF FACILITY FROM FAULT			
				HYPERION TREATMENT PLANT (IN MILES)	LOS ANGELES-GLENDALE WATER RECLAMATION PLANT (IN MILES)	SEPULVEDA WATER RENOVATION PLANT (IN MILES)	TERMINAL ISLAND TREATMENT PLANT (IN MILES)
Malibu-Santa Monica System (Potentially Active)	50±	7 7.5[1]	6	8.1	1.4	8.9	11.6
Verdugo Fault-Eagle Rock Fault (Potentially Active)	20±	6.5	5.5	19.0	1.9	6.2	27.5
Raymond Fault (Active)	12±	6.5 7.5[1]	5.5	17.8	2.9	14.7	25.8
Northridge Hills-Devonshire-Hadley Fault System (Potentially Active)	12±	6.5	5.5	21.7	12.8	3.9	36.0
Palos Verdes (Potentially Active)	40±	6 7.5[1]	5	2.8	22.5	24.8	0.0
Chatsworth (Potentially Active)	8±	6	5	22.9	18.6	7.4	39.0
Newport-Inglewood System (Active)	5-20±	7	6	5.2	10.9	9.1	6.4
Sierra Madre-San Fernando-Santa Susana Fault Complex (Active in San Fernando Area)	10±	7 6.5[1]	6	25	7.0	6.6	34.1
Whittier-Elsinore[2] System (Active ?)	200±	7.7 7.5[1]	7	23.2	16.8	27.7	20.9
San Andres-San[2] Jacinto System (Active)	800	8.25 7.5[1]	7.4	45.5	29.1	31.4	55.3

[1] Greensfelder (1972, 1974).

[2] Not shown on map, Figure II-10.

Table II-8. Earthquake recurrence frequency in selected systems (Lamar et al., 1973).

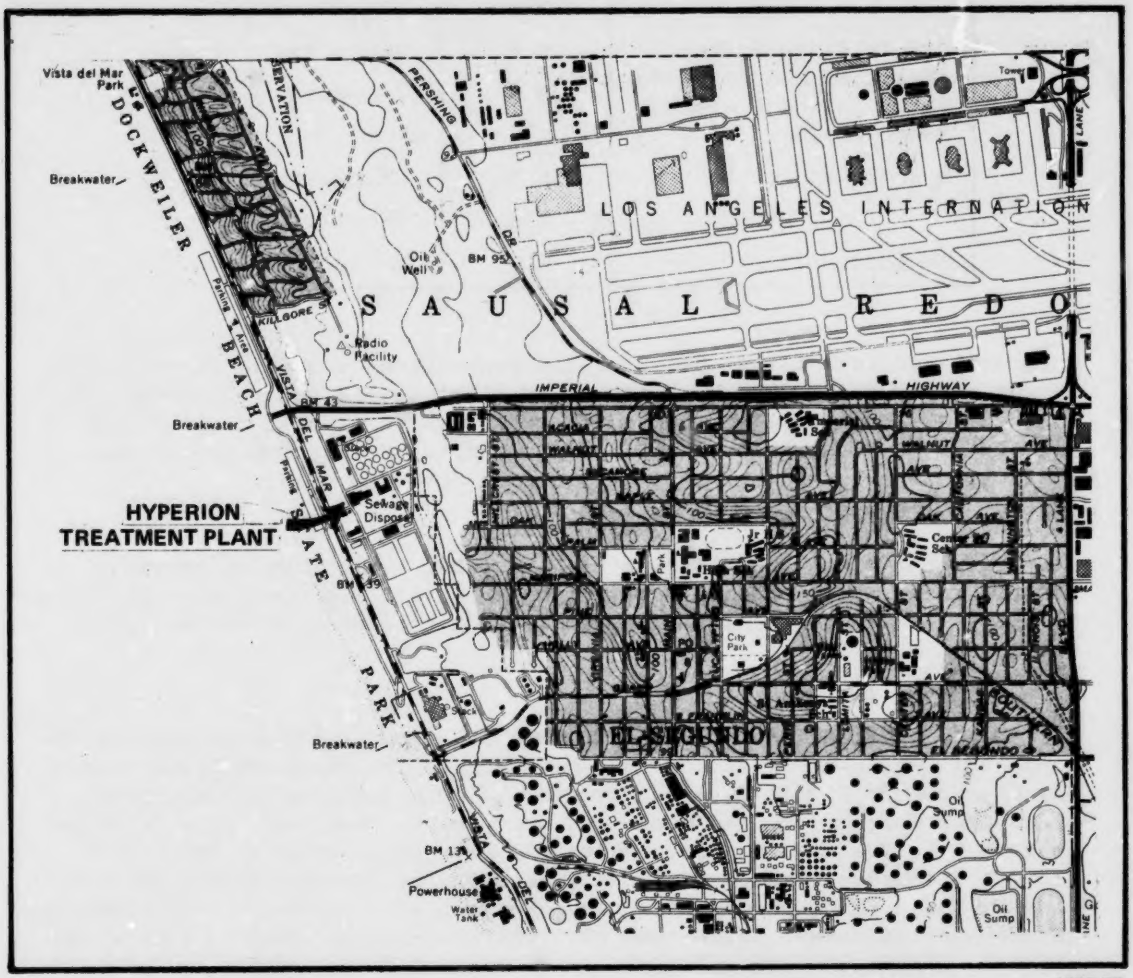
SYSTEM	MAGNITUDE	RECURRENCE
San Andreas	M 8	200 years
	M 6	10 years
Sierra Madre System (includes San Fernando Santa Susana & Sierra Madre Faults)	M 8 M 6	800 years 100 years
Newport-Inglewood	M 7	300 years
	M 6	80 years
Raymond Hill	M 6	200 years

expansive and collapsible soil. There are neither unstable cut nor fill slopes on any of the sewer treatment facilities. There are, nevertheless, earthquake damage and land subsidence problems in varying degrees that will be discussed briefly in the next section. Fuller treatments are available in the separate reports required for each plant.

c. Geological Conditions at Plant Sites. This section provides summary information on the local geologic and seismic conditions applicable to the sites of present and proposed treatment plants considered in the Facilities Plan.

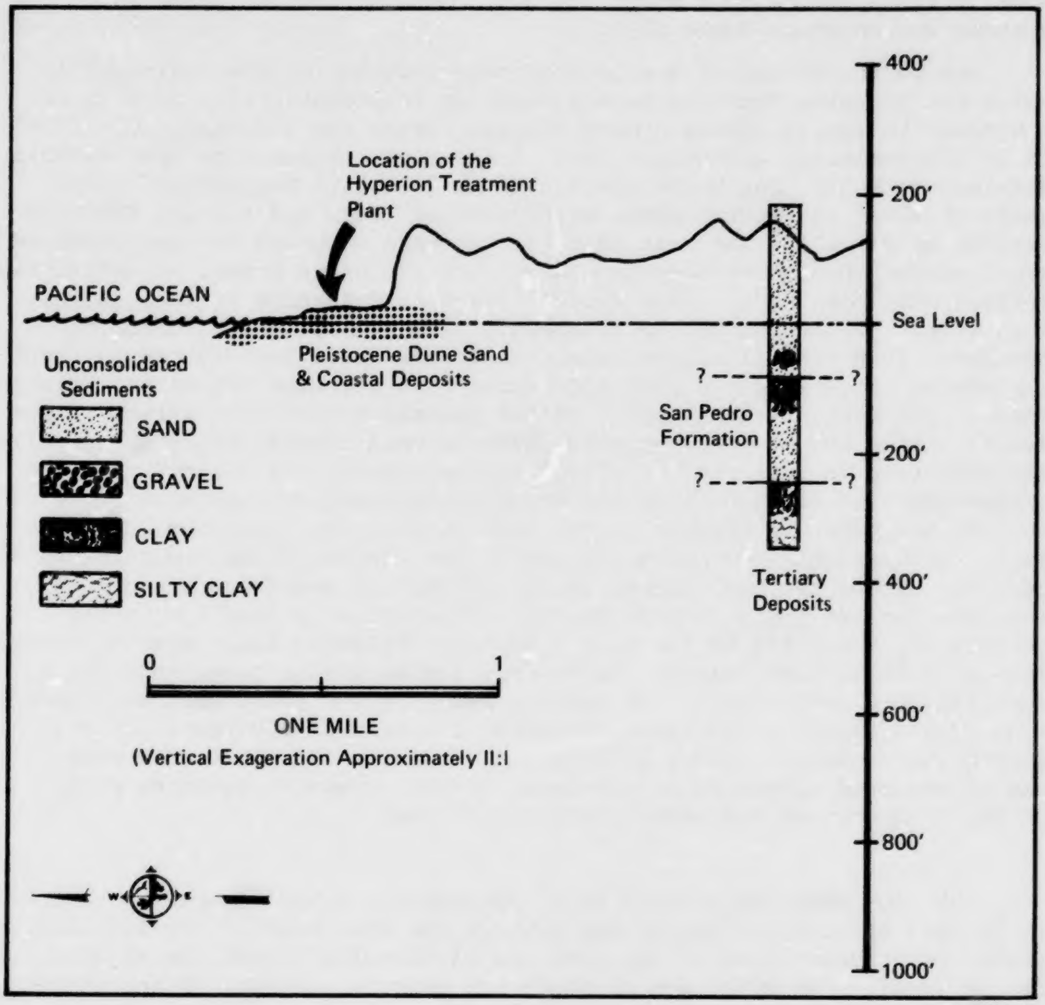
(1) HYPERION TREATMENT PLANT. The Hyperion Facility is located in Playa del Rey, near El Segundo and adjacent to the beach on Santa Monica Bay as shown in Figure II-11. The site is on a low bluff approximately 1,000 feet inland from the ocean and occupies an area which was formerly sand dunes. The sand dunes in this area have been recently deposited along the southerly shore of Santa Monica Bay by the prevailing westerly winds. These dunes are underlain by 300 feet of late to early Pleistocene unconsolidated sands, silts, and clay which were deposited in beds which range in thickness from a few inches to tens of feet. These sediments are, in turn, underlain by a few thousand feet of similar, but somewhat more consolidated, Pliocene sediments. Refer to Figure II-12 for a description of the sediments underlying the Hyperion Treatment Plant.

The solids in which the Hyperion Facility has been emplaced are a series of unconsolidated, interbedded sand, silt, and clay. The depth of the groundwater table is 30 to 40 feet, and drainage for surface water appears to be adequate.


Vista del Mar Park
DOCKWEILER
BEACH
STATE
PARK
Breakwater
Breakwater
Breakwater
HYPERION TREATMENT PLANT
PERSHING
DR
Oil Well
BM 95
KILLGORE
Radio Facility
LOS ANGELES INTERNATION
S A U S A L R E D O
IMPERIAL
HIGHWAY
BM 43
VISTA DEL MAR
Sewage Disposal
BM 39
City Park
Center St Sch
EL SEGUNDO
EL SEGUNDO
BM 13
Powerhouse
Water Tank
Oil Sump
Oil Sump
Tower
Parking Area

198P-76

Figure II-11. Topographic map of the Hyperion Treatment Plant area.



Location of the Hyperion Treatment Plant
PACIFIC OCEAN
Pleistocene Dune Sand & Coastal Deposits
Unconsolidated Sediments
SAND
GRAVEL
CLAY
SILTY CLAY
San Pedro Formation
Tertiary Deposits
? ?
400'
200'
Sea Level
200'
400'
600'
800'
1000'
0
1
ONE MILE
(Vertical Exageration Approximately II:I
W
E

198P-77

Figure II-12. Sediments underlying the Hyperion Treatment Plant as revealed by shallow onsite borings and nearby wells (after City of Los Angeles, 1976; Poland, et al., 1959).

Published geological maps do not show any faulting in the immediate vicinity of the site. The active Newport-Inglewood system is 6 miles east of the facility and the potentially active Palos Verdes fault is about 3 miles west, under the Santa Monica Bay. The northwesterly extension of this fault may be the source of some of the moderate earthquakes whose origins are plotted under the bay. The distance to other fault systems was shown in Table II-7.

Due to the thickness and lack of consolidation of the sediments in which the Hyperion Facility is emplaced, it is probable that it will be subjected to fairly strong ground shaking during its lifetime. The site is in a seismically active area and it has been subjected to four sizable shakings from the Long Beach earthquake in 1933, the Bakersfield earthquake in 1952, the Port Hueneme earthquake of 1957, and the San Fernando earthquake of 1971. The last of these has been reported to have produced minor cracks in some of the structures. As far as is known, no definitive surveys have been made of the outfall lines to determine to what extent they were: (1) thrown out of alignment, or (2) displaced in grade or buckled. Such conditions were observed at the Santa Barbara sewage treating system following the 1925 earthquake that measured 6.4 on the Richter Scale. The distance attenuation factor greatly reduced the effect of the events listed above. However, the thick unconsolidated sediments underlying the site tend to increase the effect of earthquakes. A maximum credible (magnitude 7.0) earthquake on the Newport-Inglewood system, however, would subject the plant to greater forces than it has been subjected to in the past. An earthquake of magnitude 8.0 on the Richter Scale occurring on the nearest part of the San Andreas fault (≈45 miles) would produce ground accelerations at the site that would be substantially less than those potentially generated by the nearer Newport-Inglewood fault system (Greensfelder, 1974). Lamar (1973) and Knuppel (1974) give a recurrence for a magnitude 8.0 event on the San Andreas fault of 200 years and for a magnitude of 7.0 event on the Newport-Inglewood system of 300 years. A 4.2 earthquake shook the nearby Baldwin Hills area in 1962, but seemingly had no reported effect on the Hyperion Plant. However, swimming pools in the neighborhood had water slosh out of them.

(2) LOS ANGELES-GLENDALE WATER RECLAMATION PLANT (LAGWRP). LAGWRP is located at an elevation of 440 feet on the east bank of the Los Angeles River immediately south of the west end of Colorado Street, as shown in Figure II-13. The River course marks the extreme east-end of the Santa Monica Mountains, geographically.

The material at the surface is recent alluvium which consists of interbedded sand, silt, and clay. This surface material, although unconsolidated, is fairly firm. It is underlain by an older alluvium which is composed of essentially the same material but is somewhat more consolidated and consequently firmer than the younger alluvium. The thickness of this older alluvium varies considerably from place to place and in some places it may be as thick as 400 feet. This unit is, in turn, underlain by about

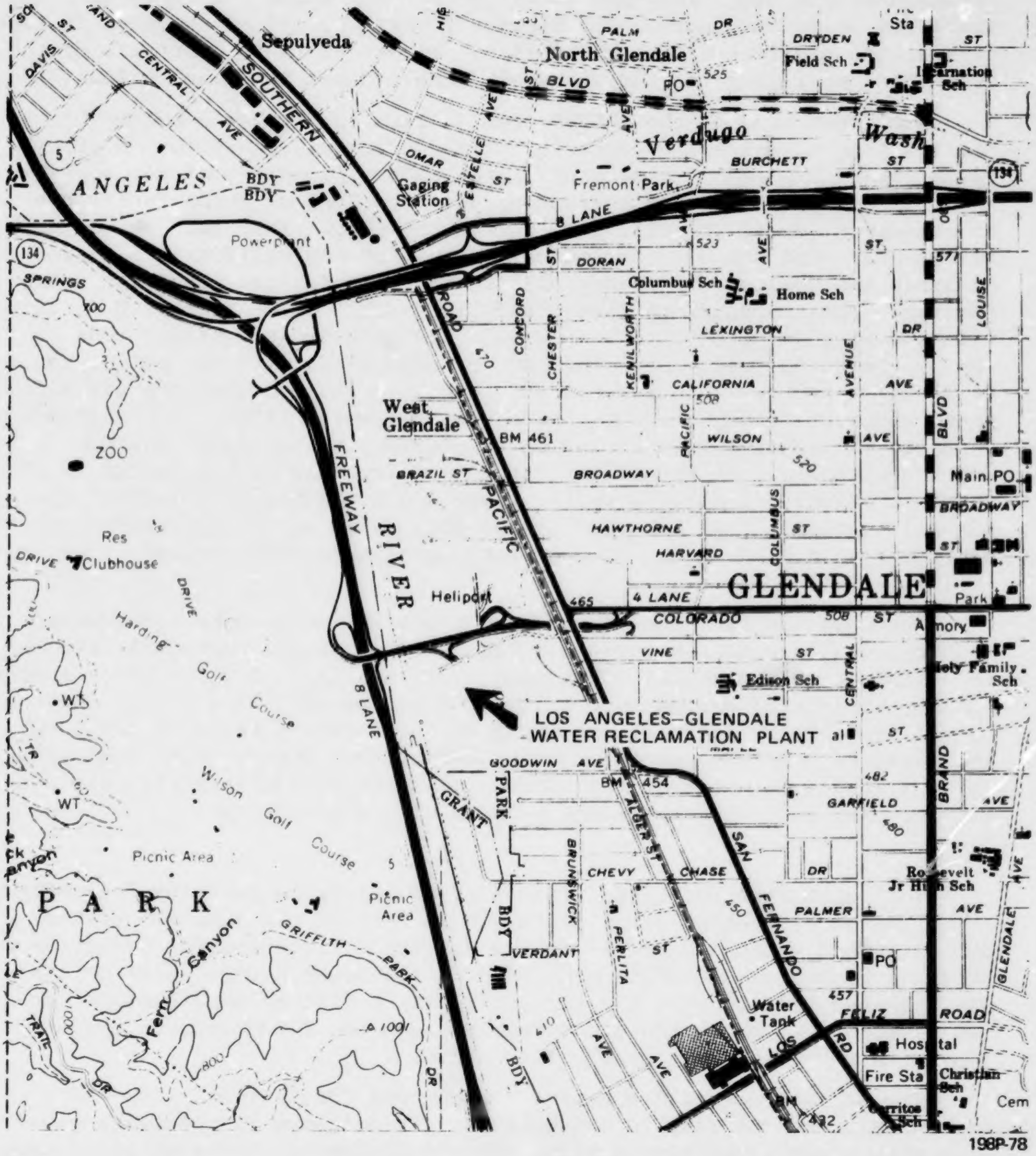

Sepulveda
SOUTHERN
CENTRAL AVE
DAVIS ST
ANGELES
BDY
BDY
Gaging Station
Powerplant
North Glendale
PALM DR
DRYDEN
Field Sch
Incarnation Sch
BLVD
PO
525
Verdugo Wash
BURCHETT ST
OMAR ST
ESTELLE AVE
Fremont Park
8 LANE
134
5
SPRINGS
700
DORAN
523
CONCORD
CHESTER
Columbus Sch
Home Sch
LEXINGTON DR
KENILWORTH
CALIFORNIA AVE
PACIFIC
508
LOUISE
571
West Glendale
BM 461
WILSON AVE
BROADWAY
BRAZIL ST
HAWTHORNE ST
HARVARD
COLUMBUS
AVENUE
Main PO
BROADWAY
ZOO
Res
Clubhouse
DRIVE
Harding Golf Course
FREEWAY
RIVER
PACIFIC
ROAD
470
520
GLENDALE
Helipart
465
4 LANE
COLORADO ST
508
Park
Armory
VINE ST
Edison Sch
Holy Family Sch
CENTRAL
LOS ANGELES–GLENDALE WATER RECLAMATION PLANT
WT
Wilson Golf Course
8 LANE
GOODWIN AVE
BM 454
ALLEN ST
482
GARFIELD AVE
BRAND
GRANT
PARK
Picnic Area
PARK
Picnic Area
BRUNSWICK
CHEVY CHASE
SAN FERNANDO
DR
Roosevelt Jr High Sch
PALMER AVE
GLENDALE AVE
BDY
VERDANT ST
PERLITA AVE
450
Griffith Canyon
Fern Canyon
GRIFFITH PARK DR
1001
1000
800
TRAIL
DR
Water Tank
457
PO
FELIZ ROAD
Hospital
Fire Sta
Christian Sch
Cerritos Sch
Cem
LOS
RD
BDY
410
432
198P-78

Figure II-13. Topographic map of the Los Angeles-Glendale Water Reclamation Plant area.

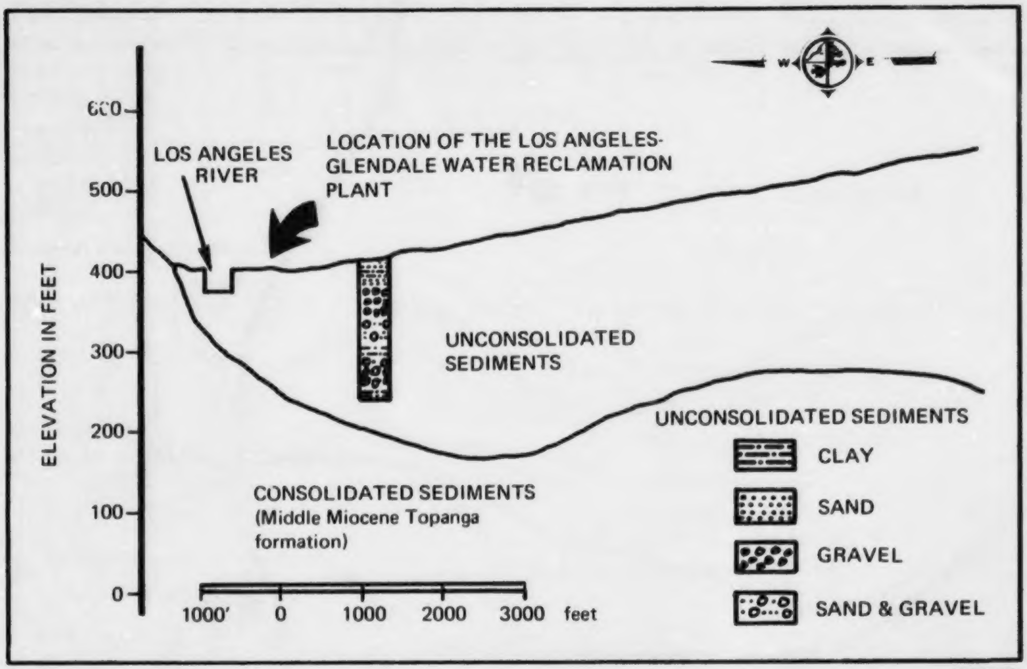
3,500 feet of middle Miocene Topanga formation which, in this area, is predominantly a hard, well-bedded siltstone with minor interbeds of hard siliceous shale and chert. The Topanga formation lies on an Upper Cretaceous crystalline basement of quartz diorite. Figure II-14 is a profile of the sediments underlying the Los Angeles-Glendale Water Reclamation Plant.

Published maps of the LAGWRP area (Lamar, 1970) show a number of faults, some of which are close to, or may transect, the site. Most of these faults are seen in outcrops of the older (pre-Pleistocene) rocks not covered by alluvium or terrace materials. Some of these faults can be projected, under the alluvium, toward the site. They are classed as inactive by both the U.S. Geological Survey and the California Division of Mines and Geology. Portions of larger active fault systems lie nearby, however. The Raymond/York Blvd. fault is about 3 miles southeast of the site and is classed as active in a 1977 special studies seismic zone map by the State Geologist. The San Fernando area, with its active faults, is 10 miles northwest at its closest point. A fault called the San Rafael shows suggested evidence of recent movement (Lamar, 1970). The Glendale Facility is situated in a narrow wedge proximal to two fault systems which are considered potentially active and actually do have short active segments (Figure II-10). However, there are two mitigating factors for potential seismic hazards. One is the absence of an overly shallow groundwater table, and the other is the presence of hard bedrock under a relatively shallow alluvial cover.

The area has been shaken numerous times in the past by earthquakes of both local and distant origin. The latest proximal earthquake was the San Fernando earthquake of 9 February 1971 (magnitude 6.5) which generated maximum horizontal ground acceleration of estimated 0.19 g and an intensity of VII (MM) in the immediate vicinity of the Glendale Facility based on its distance from the epicenter and interpolation from a state DOMG curve for the particular earthquake. There is a high probability that the plant will be similarly shaken several times during its lifetime.

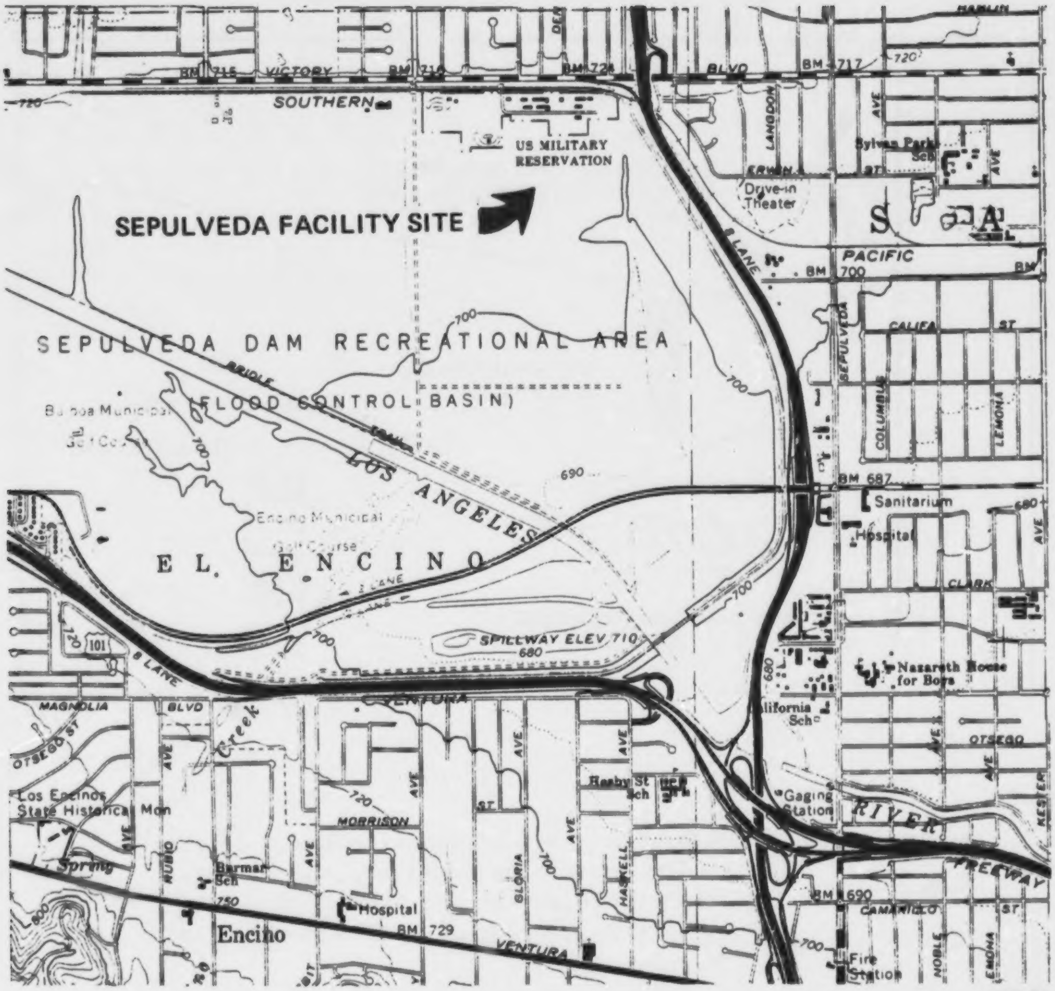
(3) SEPULVEDA FACILITY. The proposed Sepulveda Facility is located approximately 1.5 miles north and a little west of the junction of the San Diego and Ventura Freeways in the Sepulveda Flood Control Basin, as shown in Figure II-15. This places it in the south central part of the San Fernando Valley where the terrain is quite flat at an elevation of 700 feet. The Los Angeles River cuts through the flood control basin approximately 3,000 feet south of the site.

The surface material consists of Holocene (recent) alluvium which may range up to 300 feet in thickness. This alluvium is predominantly clay with minor interbeds of silt, sand, and gravel. The high percentage of clay reduces the permeability of these beds, making them less effective as aquifers than the beds in the northern and eastern portions of the Valley. The Miocene Modelo Formation lies beneath the alluvium at the site and crops out in the Santa Monica Mountains just south of the Freeway. [Ground water contours noted on a San Fernando Valley Los Angeles County


ELEVATION IN FEET
600
500
400
300
200
100
0
LOS ANGELES RIVER
LOCATION OF THE LOS ANGELES-GLENDALE WATER RECLAMATION PLANT
W
E
UNCONSOLIDATED SEDIMENTS
CONSOLIDATED SEDIMENTS (Middle Miocene Topanga formation)
UNCONSOLIDATED SEDIMENTS
CLAY
SAND
GRAVEL
SAND & GRAVEL
1000'
0
1000
2000
3000
feet

198P-79

Figure II-14. Profile of unconsolidated sediments in the vicinity of the Los Angeles-Glendale Water Reclamation Plant as measured in a nearby well (after State Water Rights Board Referee, 1962)


SEPULVEDA FACILITY SITE
US MILITARY RESERVATION
VICTORY
BLVD
SOUTHERN
PACIFIC
SEPULVEDA DAM RECREATIONAL AREA
(FLOOD CONTROL BASIN)
LOS ANGELES
EL ENCINO
Encino Municipal Golf Course
SPILLWAY ELEV 710
Drive-in Theater
Sylvan Park Sch
SEPULVEDA
COLUMBUS
LEMONA
CALIFA
ST
Sanitarium
Hospital
CLARK
Nazareth House for Boys
California Sch
OTSEGO
MAGNOLIA
VENTURA
Los Encinos State Historical Mon
MORRISON
Burbank Sch
Hospital
Encino
Gaging Station
RIVER
FREEWAY
CAMARILLO
Fire Station
NOBLE
KESTER
GLORIA
HASKELL
Hesby St Sch
LANGDON
ERWIN
8 LANE
101
BM 687
BM 690
BM 729
BM 700
BM 717
700
690
680
720
750

198P-80

Figure II-15. Topographic map of the proposed Sepulveda Facility site.

Flood Control District map show an unmistakable piedmont slope salient nosing out along the southerly edges of Sepulveda Dam. This is some form of lithologic, rather than structural, restrictive barrier to ground water movement. Since regional subsurface flow is southerly, however, the subsurface feature should pose little (or no) problem.] The Modelo formational units range up to 7,000 feet in thickness. At the site, the depth to the granitic basement is approximately 4,000 feet. Figure II-16 describes the sediments underlying the Sepulveda Facility.

The site and its immediate vicinity are free of any significant faulting. The nearest well-established potentially active fault is the Northridge Hills Fault approximately 4 miles north of the site. Some minor inactive faults occur on the north flank of the Santa Monica Mountains and a conjectural fault shown as concealed beneath the alluvium is indicated on the State Geologic Map.

This site is located on unconsolidated alluvium which is approximately 300 feet thick and resting on Miocene consolidated sandstone and shale. This situation is responsive to ground shaking and it is highly probable that the facility will experience more than one earthquake during its lifetime. The site has been shaken by several earthquakes during historic times, notably Fort Tejon, 1857; Newport-Inglewood, 1933; Arvin-Tehachapi, 1952; and San Fernando, 1971. The last earthquake (1971) produced maximum horizontal ground accelerations of 0.16 g and MM intensity of VII at the site. Faults that could affect the site area are shown in Figure II-10.

It is not possible to accurately determine the recurrence frequency of Southern California earthquakes due to the shortness of the historical record and the present state of the art of earthquake prediction. Estimates of earthquake frequency and magnitudes were shown in Table II-8. The Simi-Northridge Fault may have recurrence intervals in excess of several hundred years, but this is unclear at the present time.

(4) TERMINAL ISLAND TREATMENT PLANT. The Terminal Island site is located on the bay side near the southwest end of Terminal Island, as shown in Figure II-17. It is bounded on the east and south side by Ferry Street and Terminal Way, respectively. The site surface is level, with an elevation of plus 8 feet. The uppermost 8 or 9 feet is made up of artificial fill in the form of dredge spoils from the harbor. This material is underlain by similar but somewhat finer grained naturally deposited sediments. Both of these units have poor characteristics for foundations. Underlying these units are approximately 5,000 to 8,000 feet of older sediments. Figure II-18 illustrates these sediments for areas near the site.

The eastern half of Terminal Island has had a major subsidence problem for the past 45 years (Figure II-19). The maximum depression occurred at the northeast corner of the Island which had dropped 29 feet by 1965. Extensive dewatering of the shallow aquifers and withdrawal of petroleum from the deeper horizons are the primary causes for this subsidence.

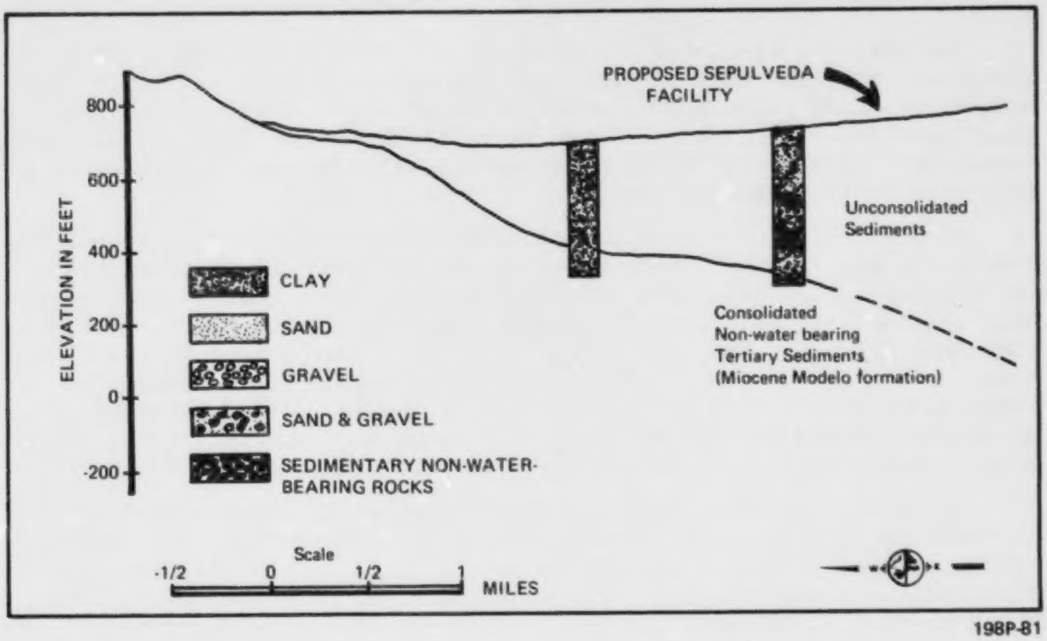
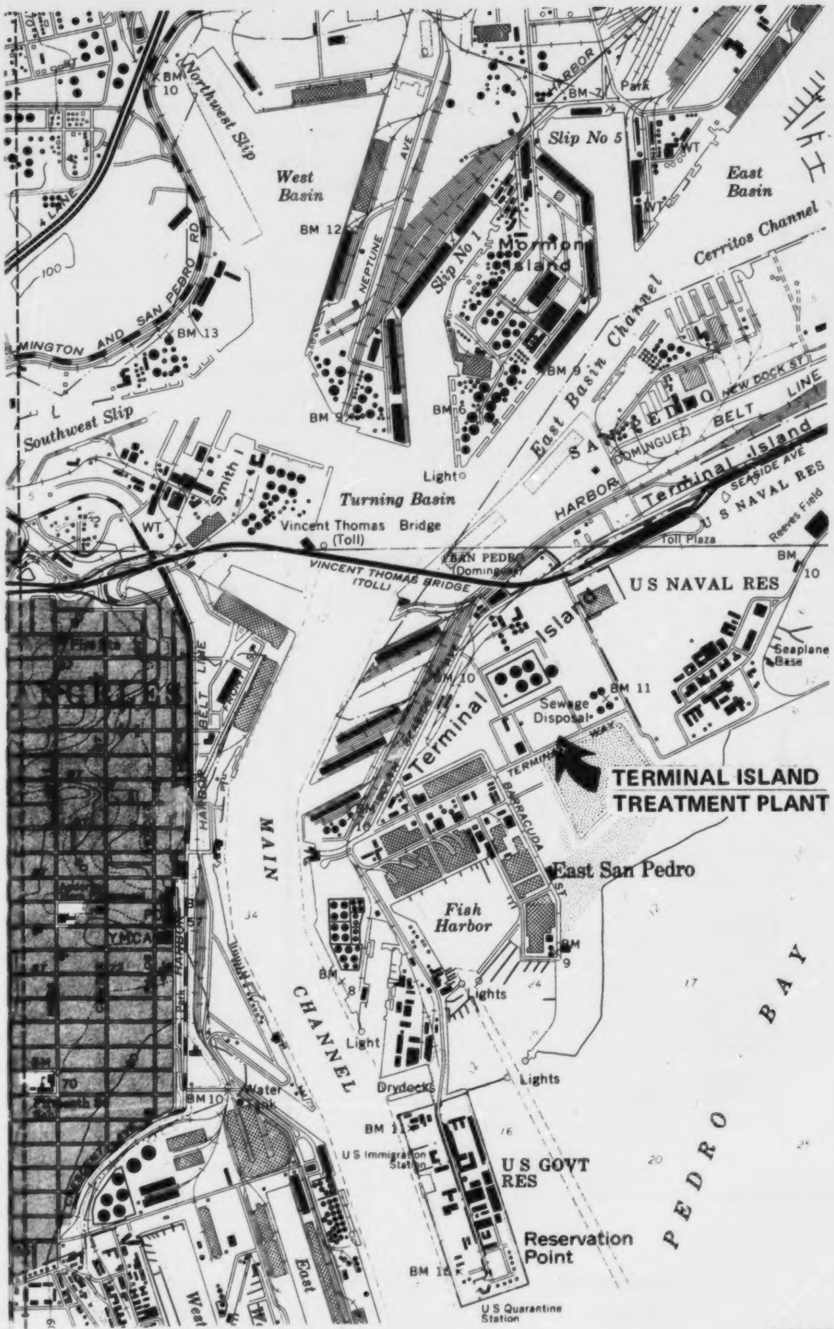
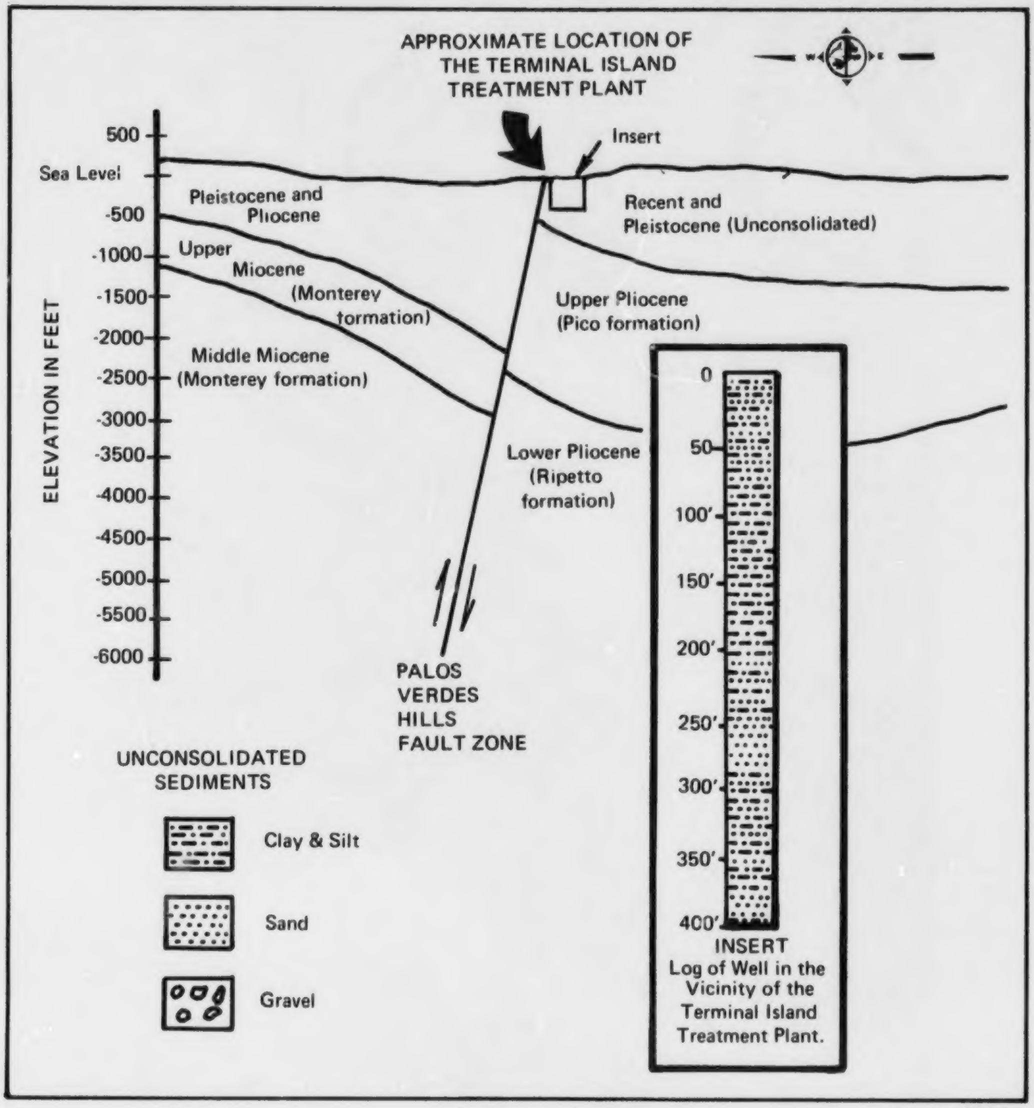

PROPOSED SEPULVEDA FACILITY
ELEVATION IN FEET
800
600
400
200
0
-200
CLAY
SAND
GRAVEL
SAND & GRAVEL
SEDIMENTARY NON-WATER-BEARING ROCKS
Unconsolidated Sediments
Consolidated Non-water bearing Tertiary Sediments (Miocene Modelo formation)
Scale
-1/2
0
1/2
1
MILES
198P-81

Figure II-16. Sediments underlying the vicinity of the proposed Sepulveda Facility as shown by logs from several nearby wells (after State Water Rights Board Referee, 1962).


Northwest Slip
West Basin
Slip No 5
East Basin
Cerritos Channel
Slip No 1
Mormon Island
NEPTUNE AVE
WILMINGTON AND SAN PEDRO RD
Southwest Slip
East Basin Channel
SAN PEDRO
NEW DOCK ST
BELT LINE
HARBOR
Terminal Island
SEASIDE AVE
U S NAVAL RES
Turning Basin
Vincent Thomas Bridge (Toll)
VINCENT THOMAS BRIDGE (TOLL)
Toll Plaza
Reeves Field
Smith
WT
US NAVAL RES
Seaplane Base
Sewage Disposal
TERMINAL WAY
Terminal Island
TERMINAL ISLAND TREATMENT PLANT
BARRACUDA ST
East San Pedro
MAIN CHANNEL
Fish Harbor
Lights
Light
Drydocks
PEDRO BAY
US Immigration Station
U S GOVT RES
Reservation Point
U S Quarantine Station
YMCA
HARBOR
East
West
Water
BM 10
BM 12
BM 13
BM 9
BM 7
BM 11
BM 8

198P-82

Figure II-17. Topographic map of the Terminal Island Treatment Plant area.


APPROXIMATE LOCATION OF THE TERMINAL ISLAND TREATMENT PLANT
Insert
500
Sea Level
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000
-5500
-6000
ELEVATION IN FEET
Pleistocene and Pliocene
Upper Miocene (Monterey formation)
Middle Miocene (Monterey formation)
Recent and Pleistocene (Unconsolidated)
Upper Pliocene (Pico formation)
Lower Pliocene (Ripetto formation)
PALOS VERDES HILLS FAULT ZONE
UNCONSOLIDATED SEDIMENTS
Clay & Silt
Sand
Gravel
0
50
100'
150'
200'
250'
300'
350'
400'
INSERT
Log of Well in the Vicinity of the Terminal Island Treatment Plant.

198P-83

Figure II-18. Sediments underlying the vicinity of the Terminal Island Treatment Plant (after Yerkes et al., 1965; Zielbaur et al., 1962).

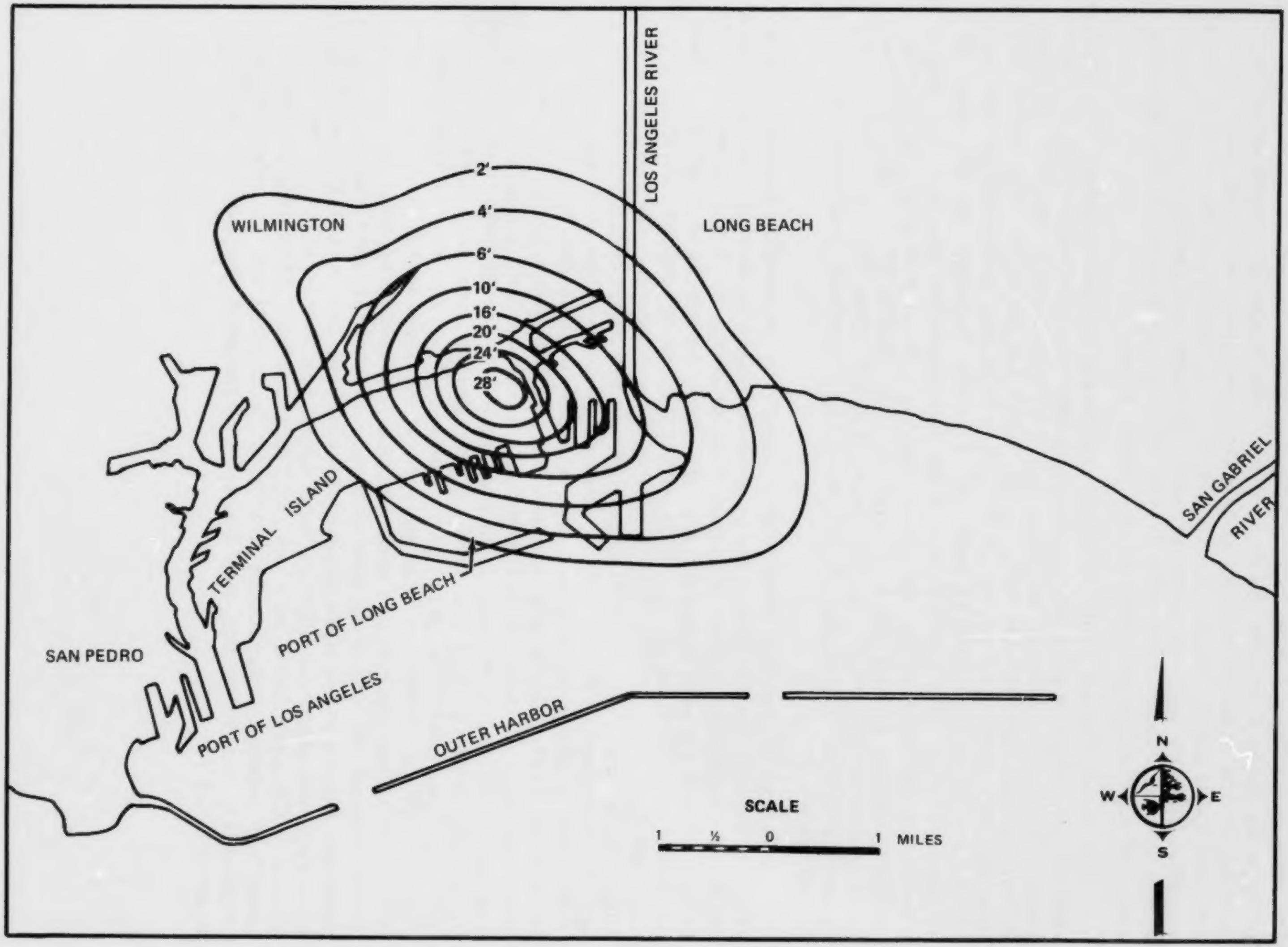
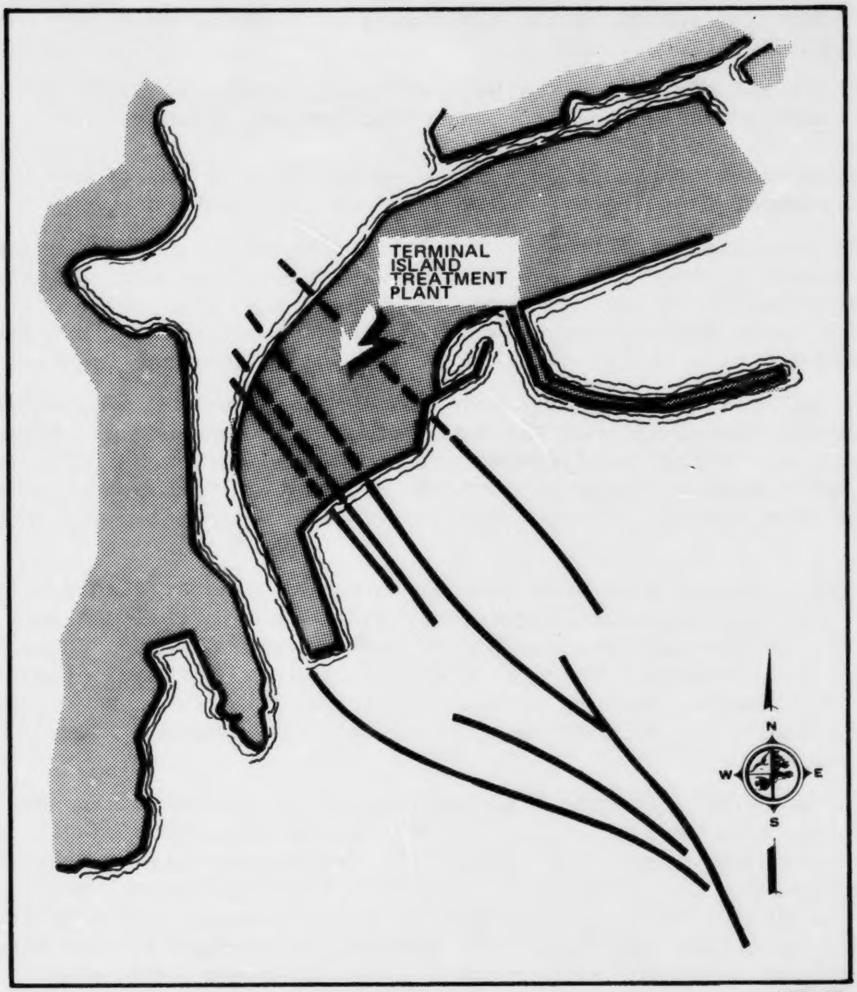

2'
4'
6'
10'
16'
20'
24'
28'
WILMINGTON
LOS ANGELES RIVER
LONG BEACH
TERMINAL ISLAND
SAN GABRIEL RIVER
SAN PEDRO
PORT OF LONG BEACH
PORT OF LOS ANGELES
OUTER HARBOR
SCALE
1 ½ 0 1 MILES
N
W
E
S
198P-84

Figure II-19. Terminal Island subsidence, 1928-1957 (Small, 1965).

The original affected area covered 20 square miles, but this has been reduced to about 4 square miles or less. The Terminal Island site is located at the extreme western edge of the original affected area and may have been subjected to possibly a foot of subsidence by 1965. Since remedial effects such as water reinjection were initiated in 1958, there has been some rebound and very little further subsidence in the maximum area and no further activity in the outer areas.

The Palos Verdes Fault strikes northwest-southeast across the northerly base of the Palos Verdes Hills and separates the peninsula from the mainland. It is classed only as potentially active by both the U.S. Geological Survey and the California Division of Mines and Geology. The fault and its branches are projected to the southeast across San Pedro Harbor and to within a few hundred feet of both sides of the Terminal Island Facility (Figure II-20). The Newport-Inglewood fault system, which is the next closest is definitely classified as active. It lies 6 miles northeast of the Terminal Island Plant (Figure II-10). Table II-7 summarized the fault characteristics of the Los Angeles Basin area and their possible seismic relationship to the four wastewater treatment facilities being investigated.

Terminal Island has been shaken mainly by several Newport-Inglewood fault-generated earthquakes, which were probably related to the subsidence activity. Although the earthquakes were moderate in their intensity, they caused damage to approximately 284 oil wells on and near Terminal Island by either crushing or severing the well casings at depths of between 1,500 feet and 1,800 feet. For damaging ground acceleration to occur at the Terminal Island site, it would appear that the Newport-Inglewood fault system (the most proximal active source) would have to generate an earthquake with a destructive power approximately equivalent to the Long Beach tremors of 1933. Since the movement in 1933 of the Newport-Inglewood fault was of the order of 6.3 magnitude (Richter) and recurrence of another earthquake of 6.0 magnitude is not anticipated for 80 years, the probability of seismic hazards from the known active nearby source is relatively low until approximately the year 2013 (Table II-7). The possibility (however remote) that a tremendous tsunami, resulting from activity in the Pacific Ocean, would hurdle the San Pedro Harbor breakwater at some future date is not beyond the realm of speculation. Another seismic hazard to the Terminal Island Plant more imminently drawn is the underlying presence of a reported swarm of hypothecated fault traces representing the Palos Verdes fault extension, as shown in Figure II-20. This fault roughly parallels submarine faults in the Catalina Channel and is adjudged as potentially active by the City Planning Department (Department of City Planning, 1975).


TERMINAL ISLAND TREATMENT PLANT
N
W
E
S

198P-85

Figure II-20. Plot plan of subsurface dislocations within the Palos Verdes Hills fault zone.

d. Mineral Resources within the Urban Area. Other than water, there are two major mineral resources within the City of Los Angeles (Planning Department, 1973)*:

- Sand and gravel, which are used almost exclusively for construction.
- Oil and gas, which are used as energy sources; oil also used as a feedstock for the petrochemical industry.

There is no loss of mineral resources to the City at any of the four sewer treatment facility sites discussed in this section.

The development of the oil and gas fields was one of the driving forces in the growth of the City, as described in Chapter V. Availability of adequate supplies of sand and gravel in the region has resulted in lower costs for these materials than would otherwise be possible, but cannot be considered as a major influence on local developmental trends.

The major sand and gravel resources in the City are located in the northeast sector of the San Fernando Valley near Hansen Dam. These materials are "mined" by open-pit methods. Some of the useful resources are alrady worked out, and much of the material is unrecoverable because of urban development. A few quarry scars of substantial magnitude still remain.

Some abandoned pits were formerly used for general disposal of solid wastes, but this practice is currently restricted to disposal only of "Group 3" wastes—that is, those that are nonwater soluble, nondecomposable, inert solids. The pits could be used for disposal of other wastes if liners acceptable to the California State Water Resources Board could be developed, or they could potentially be used as sites for groundwater recharge.

Oil was first discovered in Los Angeles in approximately 1880, leading to extensive development, exploration, and extraction of oil and gas in the subsequent years. For some time, development was not permitted in urban areas, but is now allowed subject to rigid controls. For example, a gas-oil field exists in the community of La Cienega, and a producing oil field underlies City Hall. In addition to production, Los Angeles has become a center for refining and other oil-based industries.

Local production has been decreasing in recent years because of depletion of the fields. Injection of water into the peripheries of oil-bearing formations is one method for increasing the amount of up-dip oil that can be recovered. Secondary recovery by water drive is a possible future use for reclaimed water, if seawater cannot be used because of potential contamination of useful groundwaters.

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*Other mineral deposits exist within the City, and some were mined commercially in the past. A minor mineral resource, albeit still mined in very few remaining urban areas, is clay. It is of inferior quality for ceramic purposes and is used chiefly for brick. No others are currently being extracted, and development is unlikely because of urbanization.

Production of oil is also accompanied with extraction of saline water from the oil-bearing formations. Occasionally, these trapped waters of ancient oceans penetrated by the bit afford economically recoverable chemical values, such as bromine and iodine. The Dow Chemical Company installation at Seal Beach has in the past been a forerunner in this endeavor. Improper disposal of these oil field brines can have adverse effects on surface and groundwaters, and is thus of concern in overall wastewater management programs such as the Los Angeles Areawide Wastewater Management 208 program.

3. METEOROLOGY OF THE SOUTH COAST AIR BASIN

Meteorological conditions affect the distribution of airborne pollutants and thereby local air quality conditions. Provision of additional surplus wastewater collection and treatment facilities can potentially facilitate population and employment growth opportunities in an area. If these are not reasonably proximal, private transportation facilities could result in additional emissions which are then transported or retained by meteorological conditions and affect air quality. Therefore, meteorological conditions are a baseline issue that must be appreciated before air quality and air quality impacts can be understood.

a. General Climatological Features. Almost all weather patterns affecting Southern California may be classified into four major categories (Edinger et al., 1970):

1. Pacific High Pressure Control
2. Continental High Pressure Control
3. Migratory Storm Control
4. Transitional Type Control

Pacific High Pressure Control is characterized by a well-developed, high pressure area located in the Eastern Pacific Ocean, with Southern California located in its southeast section. This occurs most frequently in the late spring, summer, and early fall when a trough of low pressure develops inland over the California-Arizona deserts giving a generally onshore flow of moist cool air at the surface. Almost always, this type of weather pattern is accompanied by a warm layer of air aloft over the cool surface layer, giving rise to an increase of the temperature with an increase in height (the temperature inversion). Other features of this pattern are: (1) frequent fog and stratus clouds near the coastline but a near absence of higher cloudiness, providing a high percentage of sunlight hours inland from the immediate coast; and (2) great vigor and regularity to the sea breeze circulation (onshore flow during the day). The combination of low altitude temperature inversion, light winds at night, and substantial sunshine during the day result in a high potential for oxidant pollution.

Continental High Pressure Control is most frequent in winter. This pattern is featured by an area of high pressure centered inland to the northeast of Southern California, frequently over the Great Basin of the North Central Rockies. It is accompanied by clear weather, coastal fog or stratus, and frequently by fairly strong easterly winds. Because this is also a high-pressure-area type, the resulting sinking air frequently produces a subsidence inversion aloft. Clear skies during the long winter nights allow cooling of the surface layer of air by radiation forming a ground-based radiation inversion, apt to be most intense at sunrise and to break up during the day as a result of surface heating. This type of control frequently produces a temperature inversion and a broad scale flow of air which tends to oppose and weaken the sea breeze circulation.

Migratory Storm Control provides deep mixing of the coastal air. Its maximum effect occurs during the times of wind and rain storms that are associated with the traveling storms of the winter half-year. Strong winds and deep mixing of the surface-released pollutants (i.e., maximum dilution) ensure clean air during these times.

Transition Type Control patterns cover the types that will not fit a well-ordered classification scheme. These in general are not important to the pollution climatology of the region since the most serious pollution hazards occur when the high pressure types are well defined and quasiuniform flow patterns exist.

Strong dry winds from northerly directions known as Santa Ana winds, are caused by unusually large and intense areas of high pressure that form or move over the Great Basin. The resulting pressure difference between the inland area and the coast causes strong winds to flow from the inland deserts through the mountain passes and onto the coastal plains. Such a condition occurs on several days each year, mostly during the fall and winter months.

The Santa Ana winds are not uniformly distributed over the coastal plains and valleys. The winds often reach peak values downwind of mountain passes, but are brought to a near standstill in other places in the lee of the mountains. A detailed study (Edinger et al., 1970) shows that when average speeds and preferred directions are considered, the flow pattern is fairly simple: (1) strong northerly flow, 10 to 25 mph, around the western end of the San Gabriel mountains and across the western half of the San Fernando Valley, then over the Santa Monica Mountains to the sea; (2) strong northeasterly flow, 10 to 30 mph, from Cajon Pass at the eastern end of the San Gabriel Mountains across the Riverside-San Bernardino Valley, through Santa Ana Canyon and across the coastal plain to the sea; and (3) between these two strong air currents, a considerably weaker flow originating on the southern slopes of the San Gabriels and moving generally toward the sea. The San Gabriels cast a "wind shadow" of diminished winds that extends to the southern beaches. Within the wind shadow is a reversal of wind direction that develops in much the same pattern as does the typical sea breeze. The reversal occurs during the midday hours from 1100 through 1500 PST and then erodes by 2100 PST. At all other hours, only winds with northerly components occur in the Los Angeles Basin under Santa Ana conditions.

b. Los Angeles Air Basin. The topography and meteorology of the Los Angeles area combine to produce an air basin. Reservations are necessary because the atmosphere cannot be strictly contained by natural barriers. In principle, the air above any geographic location on the earth will eventually be mixed with the air above adjacent locations. This freedom of air movement is enhanced by the climatological tendency for the wind to move in a preferred direction. Here, in the middle latitudes, the wind tends to blow from west to east on an overall average. Hence, air within any local basin will normally be displaced to the east and mixed with enormous volumes of air.

In the Los Angeles area, there are conditions which retard or constrain the natural mixing process. The persistent and intense elevated temperature inversion often present over Southern California greatly reduces the vertical mixing of air below it. The mountain barriers which surround Los Angeles provide a topographical constraint which allows a meteorological definition of the air basin based on the intersection of the base of the inversion layer with the major mountain barriers. Accordingly, the Los Angeles Air Basin is bounded on the west by the complex of mountains running from the higher portions of the Santa Monica Mountains to the Simi Hills to the Santa Susana Mountains. The Santa Ana and San Gabriel Mountains are the barriers on the east and the northeast, respectively. This basin tends to contain air which has been heavily polluted because the normal mixing processes are suppressed to a large extent. Polluted air which does escape from the basin in summer generally drifts east. In winter, when the climatological drift of air is from the northeast, polluted air can escape from the basin and flow well out over the Pacific Ocean.

c. Surface Winds and Pollutant Transport. Surface wind conditions in the South Coast Air Basin are characterized by a daily reversal in direction. During the period from about midday through late afternoon winds blow generally from the coast toward the interior areas of the Basin. During the hours of darkness the winds reverse and tend to blow offshore. The period between sunrise and late morning is a broad transition time during which the flow is light and variable.

The dominance of one general direction of flow over the other in Southern California varies with the season of the year. During the late spring, summer, and early fall, air flows toward the interior in most areas during the day. Air flow during late fall, winter, and early spring tends generally to move from interior areas toward the coast. The result is a seasonal variation in the strength of the immediate coastal flow; strong onshore in summer, less so in winter.

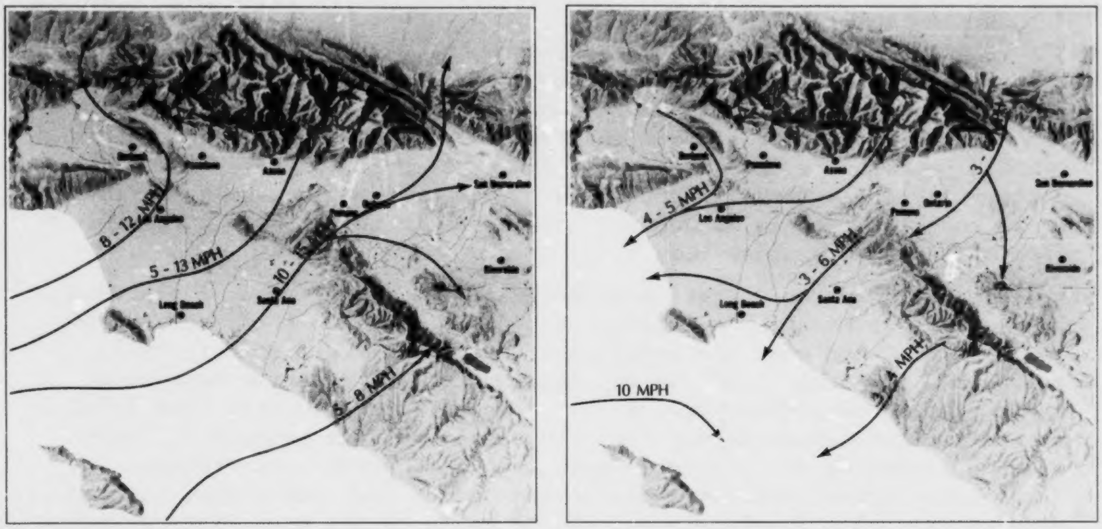
Wind near the ground surface is an important factor in pollutant dispersion and transport. Wind velocity determines how much the pollutants are diluted or concentrated. On a larger scale, the eventual location of a polluted air mass can be projected by inspecting the prevailing wind speeds, directions, and trajectories.

To say that the surface winds are solely responsible for pollutant transport may not be entirely correct. Under certain conditions, other factors apparently play important roles. For instance, zones of converging air and heated mountain slopes both act to pump the polluted air to higher levels where winds aloft may redistribute the pollutants quite differently than would surface winds alone (Edinger and Helvey, 1961; Edinger et al., 1970). The investigation of these special conditions is beyond the scope of this report. Only the winds at or near the ground surface have been considered.

The large-scale wind circulation over Southern California has been described in detail (DeMarrais et al., 1965). The winds off the coast are from a northwesterly direction in all seasons of the year, but the surface winds are deflected so that they approach the Los Angeles Basin from almost due west. Near the coastline the windflow is augmented by differential heating of land and sea masses which generate the well-known sea breeze. The combined effect over the Los Angeles Basin is a daytime sea breeze and a nighttime land breeze, both having seasonal variations in strength as already mentioned.

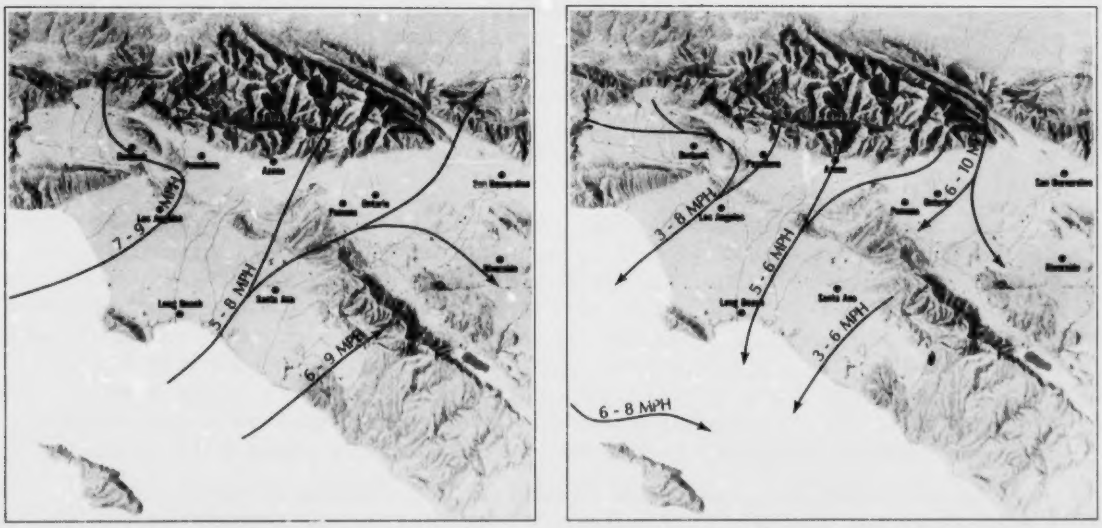
The daily and seasonal variation of the general direction of the surface wind over the Los Angeles Basin is shown by streamlines in Figures II-21 through II-24, as generalized from the report by DeMarrais. The streamlines represent winds occurring most frequently during afternoon (daytime) and early morning (nighttime) periods of two midseason months. In winter (Figure II-21), most of the daytime westerly flow that enters the Los Angeles Basin moves out to the north and northeast. There is a well-marked belt of south-southwesterly winds through the central and eastern basin which the westerly flow over the western parts of the Basin does not alter. The winter diurnal pattern shows a well-developed land breeze at night still being opposed off the coast by the westerly winds over the ocean (Figure II-22).

In the summer, (Figure II-23), the daytime air flowing into the Los Angeles Basin moves out to the north and northeast around and over the San Gabriel Mountains. The inertia associated with this daytime flow is so great that a continuation of the flow is observed in some areas until several hours after midnight. Although the diurnal pattern is weighted strongly in favor of the daytime, onshore flow, the early morning (Figure II-24) streamlines show that wind directions tend to become northeasterly across the Los Angeles Basin, as the surface airflow velocity is reduced.


8 - 12 MPH
5 - 13 MPH
10 - 15 MPH
5 - 8 MPH
Los Angeles
Long Beach
Santa Ana
Azusa
San Bernardino
4 - 5 MPH
3 - 6 MPH
3 - 4 MPH
10 MPH

TYPICAL SUMMER DAYTIME OCEAN WINDS
(Noon to 7:00 PM)

TYPICAL SUMMER NIGHT DRAINAGE WINDS
(Midnight to 5:00 AM)


7 - 9 MPH
5 - 8 MPH
6 - 9 MPH
3 - 8 MPH
5 - 6 MPH
6 - 10 MPH
3 - 6 MPH
6 - 8 MPH

TYPICAL WINTER DAYTIME OCEAN WINDS
(Noon to 5:00 PM)

TYPICAL WINTER NIGHT DRAINAGE WINDS
(Midnight to 7:00 AM)

Figure II-21/26. These maps show dominant summer and winter wind patterns in the Los Angeles Basin. For the period of the day shown, the net transport of air onshore usually is greater in the summer, while the net offshore transport as a rule is greater during the winter. Whether there is air movement or air stagnation during the morning and evening hours, before these dominant air flow patterns take effect, is one of the critical factors in determining the smog situation on any given day.

Some recent daily data taken for the California Air Resources Board shows the midmorning and late afternoon circulation differences more clearly. Figures II-25 and II-26 show specific patterns. The details of the flow are different from the longer period seasonal means but the overall pattern for the Los Angeles Basin is much the same. The midmorning pattern in Figure II-23 is more broken up than the flow shown in Figures II-22 and II-24, since it depicts conditions in the transition period from offshore to onshore flow.

The strength and penetration depth of the onshore sea breeze varies daily. The penetration of marine air can be distinguished from marine air that has been over the interior areas for 24 hours or more by a measurable contrast in chemistry, temperature and moisture content at the advancing face (Stephens, 1975). Except for those days when fresh marine air penetrates deeply into the Basin, the air beneath the subsidence inversion tends to move back and forth across the region. The large-scale atmospheric pressure pattern often does not produce sufficient wind to carry air completely out of the Basin in one day. The accumulation of air pollution thus can be integrated for a period of several days.

Recognizing the wind as a primary transport medium, researchers have fairly well defined the air flow of the Los Angeles Basin (Taylor, 1962; Chass and Hamming, 1972; Brunelle et al., 1969; and Edinger et al., undated). They have developed streamline charts which are useful for determining the prevailing wind conditions for a particular time period, but that do not describe the actual track of air parcels flowing across the basin. Studies using other techniques, such as computed trajectories and tetroon releases to study transport have also been carried out (Pack et al., 1970; Angell et al., 1972).

Surface air trajectories have been developed from the system of wind monitoring stations established by the Southern California Air Pollution Control District (SCAPCD). Trajectories trace the paths of air parcels at successive points in time, more nearly describing the movement of polluted air than do streamlines. Results show for that part of the year associated with photochemical air pollution (June to October), the computed trajectories that begin near Los Angeles International Airport (LAX) have a tendency to either cross the downtown Los Angeles-Pasadena areas or pass over the eastern San Gabriel Valley and neighboring areas further east.

Tetroon studies closely approximate the technique of following an air parcel from its point of release. One such study (Angell et al., 1972) found that, in general, tetroons over the Los Angeles area at heights of a few hundred meters tended to move slowly westward between midnight and sunrise, slowly northward between sunrise and noon, and rapidly eastward between noon and sunset. Tetroons launched during the day showed a distinct convergence zone due to the confluence of sea breezes from the west to south extending northeastward from the Palos Verdes Hills. Flights released from near Los Angeles International Airport (LAX) followed the sea breeze, invariably moving eastward initially, and then northeastward as they encountered the southerly sea breeze from the Long Beach area.

This sea breeze convergence zone moved eastward during the day, so that flights released early in the morning from near LAX tended to move into downtown Los Angeles, and flights released later in the day into the east San Gabriel Valley.

More recently, trajectories have been produced from wind field models that use as input surface wind observations and available profile data of winds, temperature and stability aloft. Specific days of interest are selected from historical data records and hourly values of wind speed and direction are computed, usually on a grid, for the area and times of interest. Three trajectories produced from a computer model using inputs for 25 September 1975 are given in Figure II-27. The input data were representative of the air flow on days in which smog can be found at significant levels within the South Coast Air Basin.

The expected daytime flow from the harbor area through downtown Los Angeles and then eastward is seen in the trajectory derived from wind model outputs, starting near Point Fermin. The early morning light and variable winds are also evident. Drainage flow from the San Gabriel Mountains during the morning and the subsequent channeling along the north side of the Santa Monica Mountains is a common phenomenon and some similar flow pattern usually exists on high oxidant days in the San Fernando Valley. The trajectories in the west valley take a northerly component about midday as the usual coast to mountains flow sets up in the early afternoon. This carries pollutants northward against the San Gabriel Mountains. The model used to compute the wind vectors was developed by Science Applications, Inc. (Sklarew and Wilson, 1976) and adapted for use on this project to provide a pollutant transport technique.

Although the prevailing directions of summer and winter wind patterns appear to be similar (daytime sea breeze, nighttime land breeze), the sea breeze flow is least well marked in winter, being disrupted by fronts, troughs, and Santa Ana type winds. This lack of persistent undirectional flow in winter results in the lowest seasonal net horizontal transport of air. In summer the stronger sea breeze flow penetrates farther inland and continues through the coastal mountain passes, frequently lasting through the night. Contaminated air parcels are thus transported farther inland into the San Gabriel Valley. The greater distance of travel in summer, the larger amounts of solar radiation to which contaminants are subjected, and the more persistent elevated inversion combine to ensure more complete photochemical reactions. Therefore, in the inland valleys and at the ends of the transport paths high oxidant concentrations are observed in summer, although considerable dilution occurs as the air travels inland. If morning wind speeds are low, then high oxidant concentrations may be produced before the air parcels move very far into the inland valleys.

d. Temperature Inversions. Normally the temperature of the atmosphere decreases with height, but in Southern California the situation is often reversed or inverted. Temperature begins to increase with height at some altitude in the lower atmosphere, the air within the "inverted" layer being extremely stable, so that very little vertical mixing takes place. Several types of inversion situations are possible as shown in Figure II-28. The height at which the temperature increase begins varies depending on the meteorology and the time of day. The mixing depth is defined by the height of the beginning point or base of the inversion.

Relatively cool surface air temperatures (the effect of an upwelling of cool ocean water at the coast) and warm, dry subsiding air aloft cause inversions on about 90 percent of the days annually. The annual average occurrence of inversions based at the surface (Figure II-28a) is 11 days per month. Inversions based between the surface and 3500 feet above sea level (Figure II-28b) occur on an average of 16 days per month year around. These inversions and the frequent occurrence of early morning low wind speeds that cause air pollutants emitted into the surface air layer to increase in concentration and to fail to dissipate before photochemical smog episodes can occur (County of Los Angeles Air Pollution Control District, 1974; County of Los Angeles, 1974).

The summer height of the inversion base with respect to mean sea level is lowest along the north coastal parts of the Basin (1000 to 1300 feet) and increases in height toward the south (1500 to 2000 feet) and over the interior portion (2000 to 4000 feet). During late fall months, the base of the inversion varies from less than 300 feet to about 1200 feet.

During the hottest days of the summer and early fall, at interior locations (San Bernardino-Riverside County), the inversion thickness is diminished appreciably. Because of the heating of marine air during the long travel distances from coast to interior, the temperature contrast between the surface air layer and the warm air above it becomes less and entirely disappears close to the slopes of the eastern mountain ranges.

During winter months, in the absence of storm activity, the ground cools and radiation type inversions accompanied by fog may occur along the coast and over the interior portions of the basin (San Bernardino-Riverside area) at night and in the early morning hours. The thickness of this inversion layer and the stable air temperature gradient throughout the basin are effective in holding pollutants near ground level in these situations.

A detailed study of inversions in the South Coast Air Basin has shown that the inversion base may not always define the top of the polluted atmosphere, but that the top of an inversion forms a definite but not absolute boundary of vertical mixing (Edinger et al., 1970). Most of the literature refers to the base of the inversion as defining, or at least limiting the vertical extent to which pollutants below it

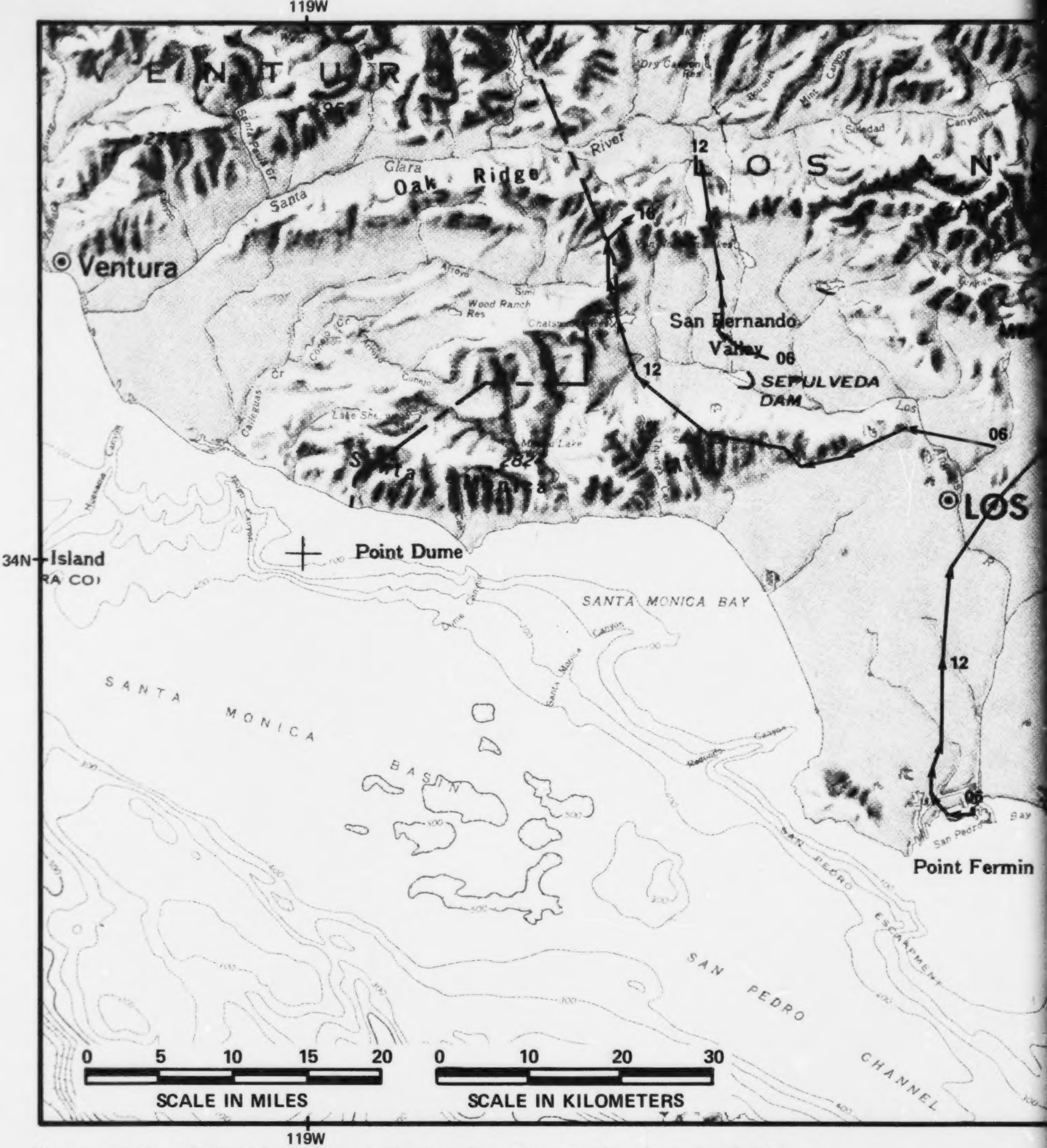

119W
V E N T U R A
Santa Clara River
Oak Ridge
Ventura
Arroyo Simi
Wood Ranch Res
Chatsworth
Dry Canyon Res
Bouquet
Mint Canyon
Soledad Canyon
L O S A N
12
16
12
06
12
06
San Fernando Valley
SEPULVEDA DAM
Los
06
Lake Sherwood
Conejo
Calleguas Cr
Santa Monica
2822
LOS
34N
Island
Point Dume
SANTA MONICA BAY
Dume Canyon
Santa Monica Canyon
SANTA MONICA BASIN
Redondo Canyon
12
06
San Pedro Bay
Point Fermin
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
0
5
10
15
20
SCALE IN MILES
0
10
20
30
SCALE IN KILOMETERS
119W

Figure II-27. Selected wind trajectories for three basin sites developed from morning wind vectors (0600-1600 PST).

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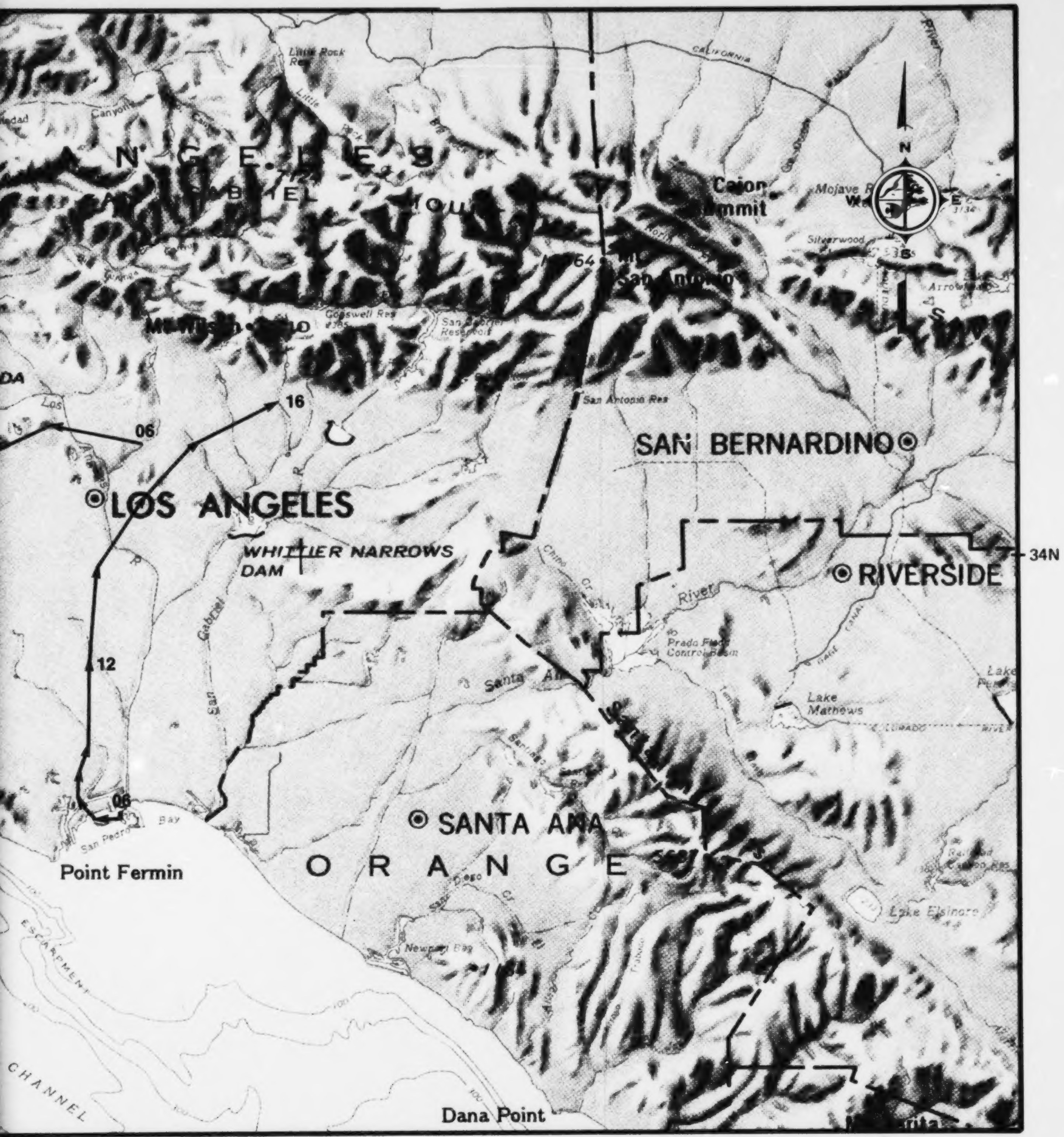
Little Rock Res
Little Rock
CALIFORNIA
Canyon
A N G E L E S
SAN GABRIEL
MOUNTAINS
Cajon Summit
Mojave R
N
W
E
S
Silverwood
Arrowhead
Mt San Antonio
10064
Mt Wilson 5710
Cogswell Res
San Gabriel Reservoir
San Antonio Res
16
06
SAN BERNARDINO
LOS ANGELES
WHITTIER NARROWS DAM
Chino Cr
River
34N
RIVERSIDE
Prado Flood Control Basin
San Gabriel R
12
Santa Ana
Lake Mathews
COLORADO RIVER
Lake Perris
06
San Pedro Bay
Point Fermin
SANTA ANA
O R A N G E
Railroad Canyon Res
Lake Elsinore
Newport Bay
ESCARPMENT
100
CHANNEL
Dana Point
Margarita

198P-91

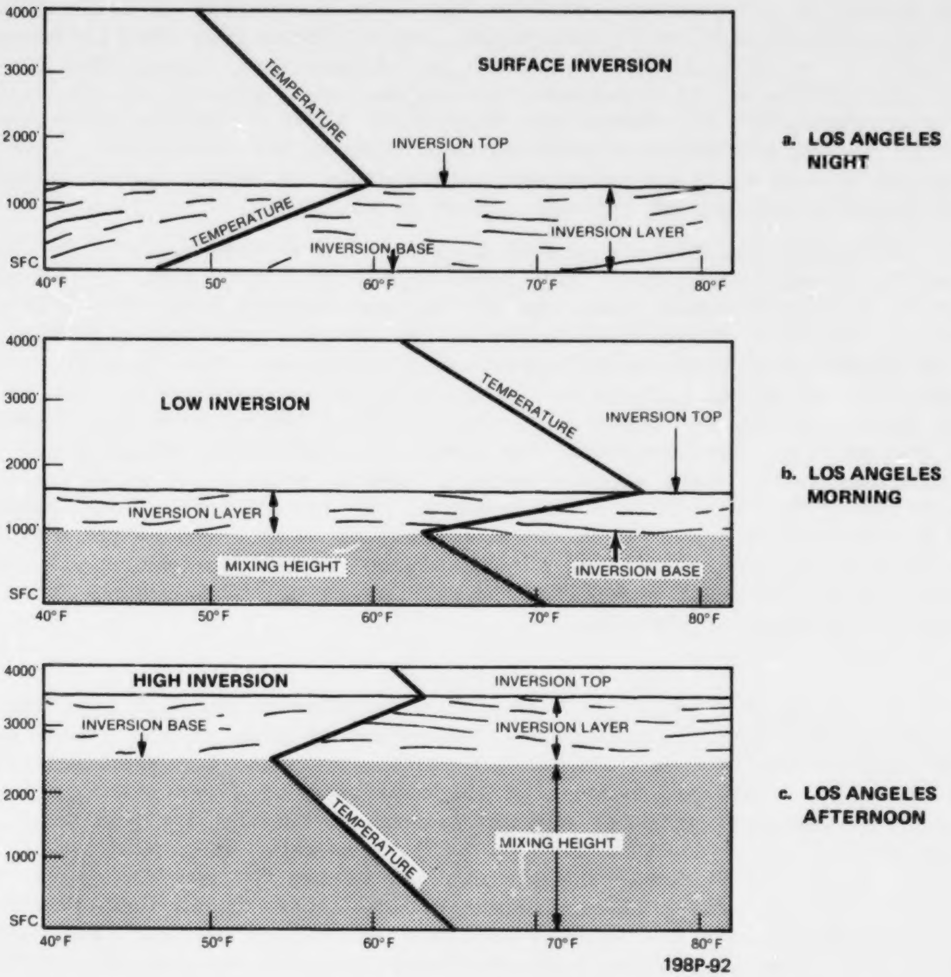
4000'
3000'
2000'
1000'
SFC
SURFACE INVERSION
TEMPERATURE
INVERSION TOP
INVERSION LAYER
TEMPERATURE
INVERSION BASE
40° F
50°
60° F
70° F
80° F
a. LOS ANGELES NIGHT
LOW INVERSION
TEMPERATURE
INVERSION TOP
INVERSION LAYER
MIXING HEIGHT
INVERSION BASE
40° F
50° F
60° F
70° F
80° F
b. LOS ANGELES MORNING
HIGH INVERSION
INVERSION TOP
INVERSION BASE
INVERSION LAYER
TEMPERATURE
MIXING HEIGHT
40° F
50° F
60° F
70° F
80° F
c. LOS ANGELES AFTERNOON
198P-92

Figure II-28. Pictorial representation of temperature inversions (from SCAPCD, 1975).

can be mixed. The lower the inversion base, the less volume there is available for mixing and the higher the pollutant concentrations are apt to be. This relationship between pollutant concentration and inversion base height is not always observed, but at least one study (Neiburger and Edinger, 1954) suggests that such a trend may occur.

Two mechanisms are responsible for the formation of most inversion layers. One relies on cooling from below. On cold clear nights, the ground surface radiates its heat out into the atmosphere. By conduction, a layer of air next to the ground surface is cooled. The vertical temperature structure of the lower atmosphere is then made up of cool air

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capped by warmer air, an inversion layer. This type of inversion is called the radiation of ground-based inversion. It frequently is found in the morning following a cool clear night, but is often destroyed by midmorning because of solar heating. Another type of inversion occurs when the mean vertical motion of high pressure air masses are subjected to compression as they descend. The warmed air eventually finds a resting place atop a cool marine air layer, resulting in a temperature inversion. This type of inversion is an elevated or subsidence inversion and is normally not found at the ground surface (Smith et al., 1972).

Neiburger and Edinger (1954) mapped the inversion base height both temporally and spatially. They found that from day to day, the average height of the inversion base varied, and was uniform over the entire Basin. During a single day, however, the height variation differed from coastal sections to the valleys and foothills. The inversion base had its maximum height in the morning at a coastal area, but in the afternoon had its maximum at the foothills inland from the coast. On the average, the inversion was lowest just offshore, sloping up toward the land. In the early morning, the inversion height became practically horizontal from the coast to the inland foothills. Table II-9 provides information on the frequency of occurrence of inversions at various heights. The data was tabulated from measurements made from 1950 through 1974 and shows that inversions at or below 5000 feet occurred about 87 percent of the time.

e. Climatic Conditions. Since Los Angeles is located on a coastal plain within the influence of the semipermanent high pressure zone of the eastern Pacific, its climate is usually mild and tempered by moderate sea breezes. However, because of the closeness of deserts and high mountains, temperature extremes are not uncommon. In the downtown area, the mean annual temperature is 64.4°F, with an average daily maximum of 74.0°F and a minimum of 54.8°F. The extreme low during the past 30 years was 28°F, in January 1949; the extreme high was 110°F, in September 1955. July and August are the hottest months with average maximum temperatures of 83.3°F. January is the coldest with an average minimum of 46.6°F. In general, coastal sections have more moderate temperatures than downtown Los Angeles, and inland valleys have both higher maximum temperatures and lower minimum temperatures.

Practically all of the yearly average total of 14.68 inches of rain falls during the six-month, November-April period. Summer rainfall normally is restricted to scattered shower activity in the Los Angeles area, the most significant amounts falling in the mountains. Monthly and yearly rainfall totals are extremely variable, no measurable rain having been recorded at least once in each of the twelve months during the past 30 years. In January 1969, 14.94 inches of rainfall was measured in downtown Los Angeles, an amount greater than the average annual precipitation.

Table II-9. Frequency of morning inversion base heights (hundreds of feet), period of record, 1950-1974 (from SCAPCD, 1974).

INVERSION BASE HEIGHT FT X 100	NUMBER OF OCCURRENCES	RELATIVE FREQUENCY OF OCCURRENCE	CUMULATIVE FREQUENCY
000	0	.000	.000
001	3209	.354	.354
002	11	.001	.355
003	40	.004	.360
004	113	.012	.372
005	107	.012	.384
006	140	.015	.399
007	131	.014	.414
008	188	.021	.435
009	129	.014	.449
010	227	.025	.474
011	127	.014	.488
012	221	.024	.512
013	160	.018	.530
014	226	.025	.555
015	170	.019	.574
016	205	.023	.596
017	171	.019	.615
018	157	.017	.633
019	168	.019	.651
020	158	.017	.669
021	112	.012	.681
022	117	.013	.694
023	114	.013	.706
024	89	.010	.716
025	80	.009	.725
026	107	.012	.737
027	82	.009	.746
028	106	.012	.758
029	71	.008	.765
030	91	.010	.775
031	51	.006	.781
032	82	.009	.790
033	65	.007	.797
034	77	.008	.806
035	73	.008	.814
036	48	.005	.819
037	60	.007	.826
038	47	.005	.831
039	37	.004	.835
040	40	.004	.839
041	25	.003	.842
042	39	.004	.847
043	37	.004	.851
044	45	.005	.856
045	36	.004	.860
046	25	.003	.862
047	25	.003	.865
048	31	.003	.868
049	36	.004	.872
050	14	.002	.874
051-990	1	.000	.874
991	170	.019	.893
992-998	0	.000	.893

Although Los Angeles has a semi-arid climate, the air near the surface is quite moist. Except for infrequent periods of dry, continental, offshore winds, the ocean effect is dominant. Periods with heavy fog are frequent, and low stratus clouds (sometimes referred to as "high fog") are the most characteristic climatic features. In downtown Los Angeles, the noon relative humidity averages 47 percent and the early morning relative humidity 75 percent.

With light average wind speeds, the Los Angeles atmosphere has a limited capability to disperse air contaminants horizontally. The average speed is 5.7 miles per hour (mph), with little variability seasonally, summer wind speeds averaging slightly less than winter wind speeds. The typical daily wind regime is broken only by occasional winter storms and infrequent strong, northeasterly Santa Ana flows from the mountains and deserts north of the City. A low average morning (6:00 a.m. to noon) wind speed is an important indicator of air stagnation potential. In Los Angeles, the average morning wind speed is 5.1 mph.

Diurnal variations in speed for three stations are shown in Figure II-29. The low early morning and late night wind speeds (less than 6 mph at LAX; less than 3 mph at Azusa) are apparent. The midday peak for LAX is just under 13 mph, giving a total range of approximately 7 mph for the most variable station. Figure II-30 shows wind roses indicating the distribution of speeds and directions for selected stations in the South Coast region.

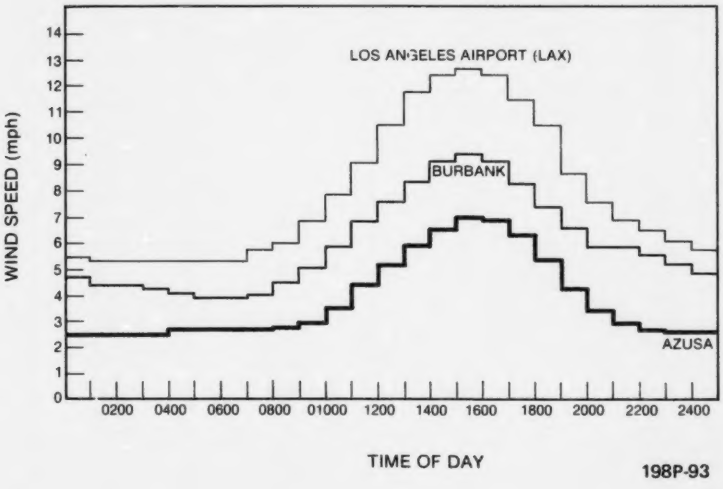


Figure II-29. Diurnal variations in wind speeds from three selected monitoring stations (SCAPCD, 1974).

4. AIR QUALITY OF THE SOUTH COAST AIR BASIN

Air quality within the South Coast Air Basin has been of concern for some time. The attention focused on the Los Angeles "smog" by those concerned with health and human welfare, particularly in recent years, has highlighted the problem and been largely responsible for the accumulating body of knowledge now available for analysis. Meteorological and Air Quality measurements have been made within the air basin for over 20 years (Taylor, 1965). Figure II-31 shows current air monitoring stations within the South Coast Air Basin. These stations are operated by the California Air Resources Board and the zones of the Southern California Air Pollution Control Districts. Within the last 10 years much has been done to compile both air quality and meteorological data in a usable form suitable for air quality trends to be studied.

a. Ten-Year Trends Basinwide. One of the most recent analyses of the existing body of air quality data for the South Coast Air Basin was done by a group at the California Institute of Technology (Trijonis et al., 1976). Their approach summarized air quality data in conjunction with emissions inventories to compare the trends in air quality and emissions from 1965 through 1974. Figures II-32 through II-34 show the resulting ten-year emissions trends for designated sources, both mobile and fixed. Note the upward trend in nitrogen oxides (NO_x) and the somewhat irregular downward trend in reactive hydrocarbon emissions (RHC). Carbon monoxide (CO) emissions show little change, and Trijonis et al. suggest several reasons for this, including possible data quality problems, effects of meteorology, and sampler locations within regions of saturated traffic load. Figures II-35 through II-37 show percentage changes in emissions determined by Trijonis et al. for each county within the South Coast Air Basin for NO_x, RHC, and CO, as well as the air quality changes for stations within Los Angeles County.

The relatively good correspondence between NO_x emissions and ambient NO_x concentrations overall is apparent in Figure II-35. The closeness of the agreement in percentage change is somewhat fortuitous as evidenced by the ranges of percent change at each monitoring station. In any event, the increasing trends and similar magnitudes do support a conclusion of good correspondence for both sets of NO_x data.

The RHC and NO_x emissions (Figure II-36) show a less clear-cut relationship due to the complex reaction/interaction among hydrocarbons, NO_x, and sunlight, which produces aerosols and oxidant through photochemistry. It is probably correct to conclude that the 18 percent decrease in RHC emissions and the 19 percent decrease in oxidant concentration may be related and that the 36 percent NO_x emission increase is more or less independent of the RHC/oxidant reaction (Trijonis and Arledge, 1975). This tentative conclusion is supported when the increase in the NO_x air concentrations (+35%) is compared to the NO_2 concentration changes (+20%) given in the report (Trijonis et al., 1976). The differences between the

NO_2 and NO_x percent increases in concentration and their random distribution also suggest that significant pieces of information are still lacking in the total hydrocarbon, oxidant, NO_x, NO_2 picture. Recent action by the California Air Resources Board to adopt a three-category hydrocarbon reactivity classification system is the result of a need to standardize and simplify the approach to this problem (California ARB, June 1976).

It is somewhat surprising that relatively inactive carbon monoxide does not behave very well in comparisons of emissions changes with air quality changes (Figure II-37). Trijonis indicates the possibility of errors in the air quality data that vary from year to year (masking true trends) and exposure or location difficulties that effect the representativeness of the measurements.

Earlier investigations into carbon monoxide and smog (Westberg, Cohen and Wilson, 1971; Dodge and Bufalini, 1972) resulted in some indications of carbon monoxide affecting smog formation under certain conditions in smog chamber studies but little effect would be expected in the open atmosphere. In any case, the agreement is poor between emissions data and air quality for carbon monoxide for the Los Angeles area, although both sets of figures show a downward trend.

b. Individual Station Data. In addition to the above trends, which are general in nature, a closer look at some of the recent individual station air quality statistics points up some interesting details. Table II-10 is a composite of selected data summarized by the various air pollution agencies with interests in the South Coast Air Basin. The 14 stations chosen include 11 within Los Angeles County, 1 in Orange County, 1 in Riverside County, and 1 in Ventura County. The table has some gaps in it as data was not taken at all locations for all pollutants and in some cases summarized data for a station is not available. Table II-11 provides a comparative listing of the currently established pollutant standards. The California standards were adopted in 1969 and 1970 by the Air Resources Board and the Federal Standards in 1971. The California 24-hour standard for sulfur dioxide was revised from 0.04 parts per million (ppm) to 0.10 ppm in 1974. Although the state and federal standards are based on the same averaging times, the numerical values are not the same in some cases. Where this occurs the more stringent standard is used for compliance (California Air Resources Board, 1974).

The ozone (oxidant) values have been corrected in accordance with the determination in late 1974 (California Air Resources Board, 1974) that Los Angeles County measurements were low and others about 20 percent too high. This difference was caused by the use of differing analytical procedures with slightly different output results. Acceptance of a common base of reference resolved the issue and established the proper instrument/procedure reference for compatible data. From the table, the highest hourly average oxidant value between 1971 and 1974 occurred in Pasadena

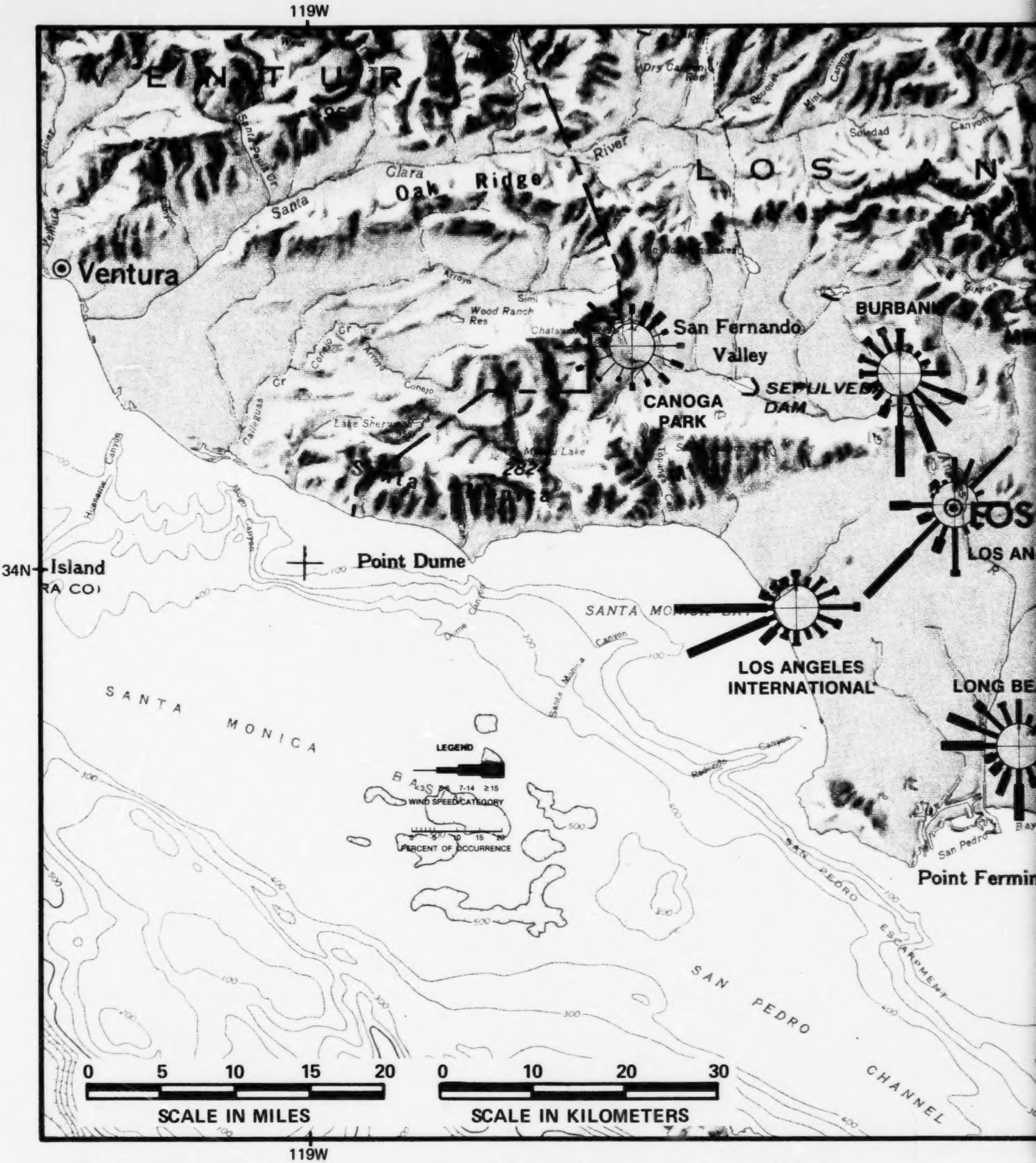
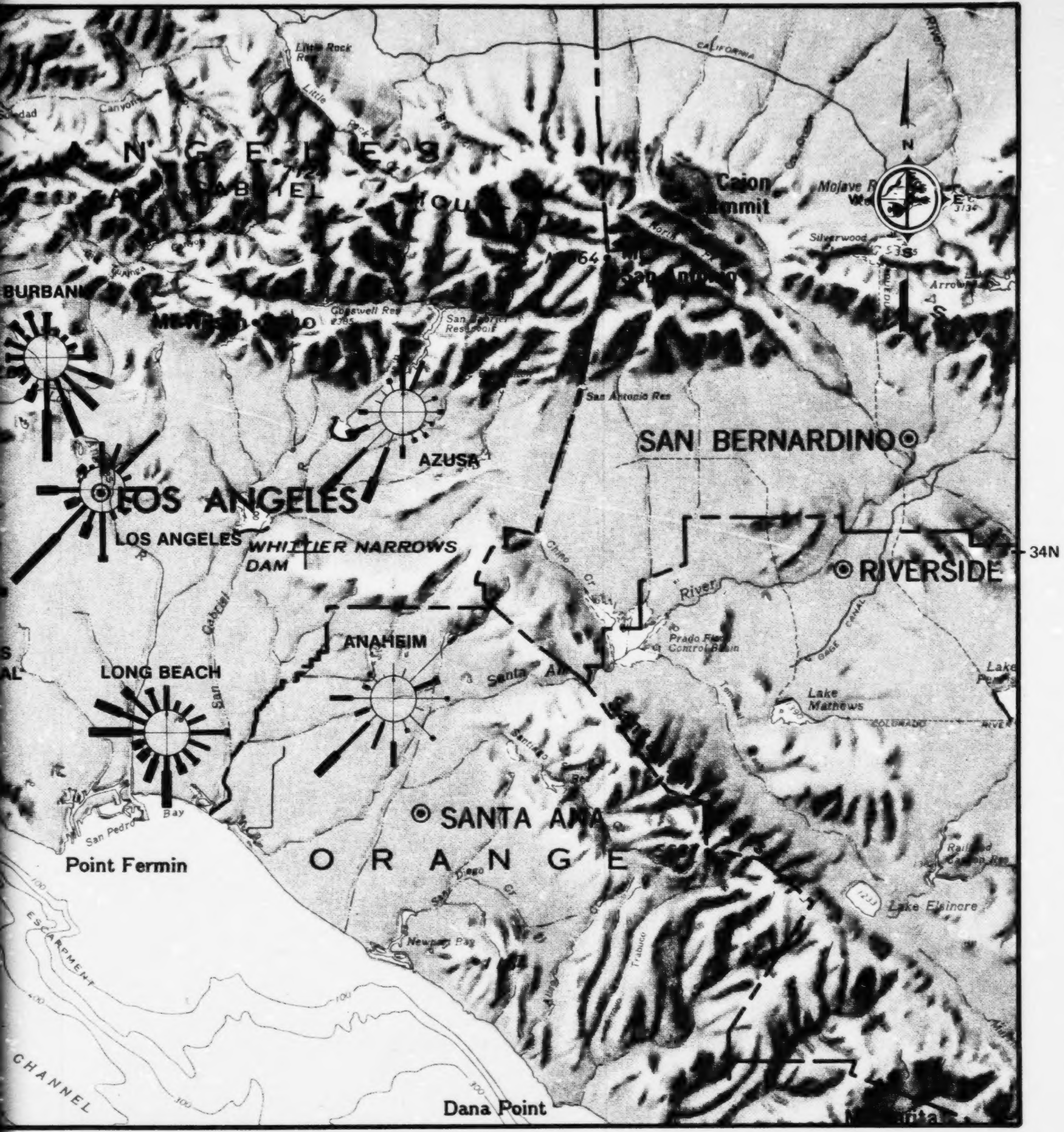

119W
VENTURA
LOS AN
Oak Ridge
Santa Clara River
Ventura
San Fernando Valley
CANOGA PARK
SEPULVEDA DAM
BURBANK
LOS
LOS AN
Point Dume
34N
Island
SANTA MONICA BAY
LOS ANGELES INTERNATIONAL
LONG BE
Point Fermin
SANTA MONICA BASIN
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
LEGEND
<3
4-6
7-14
≥15
WIND SPEED CATEGORY
0 5 10 15 20
PERCENT OF OCCURRENCE
0 5 10 15 20
SCALE IN MILES
0 10 20 30
SCALE IN KILOMETERS
119W

Figure II-30. Wind roses for representative monitoring stations within the Los Angeles area (SCAPCD, 1975).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Little Rock
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MOUN
Cajon Summit
Mojave R
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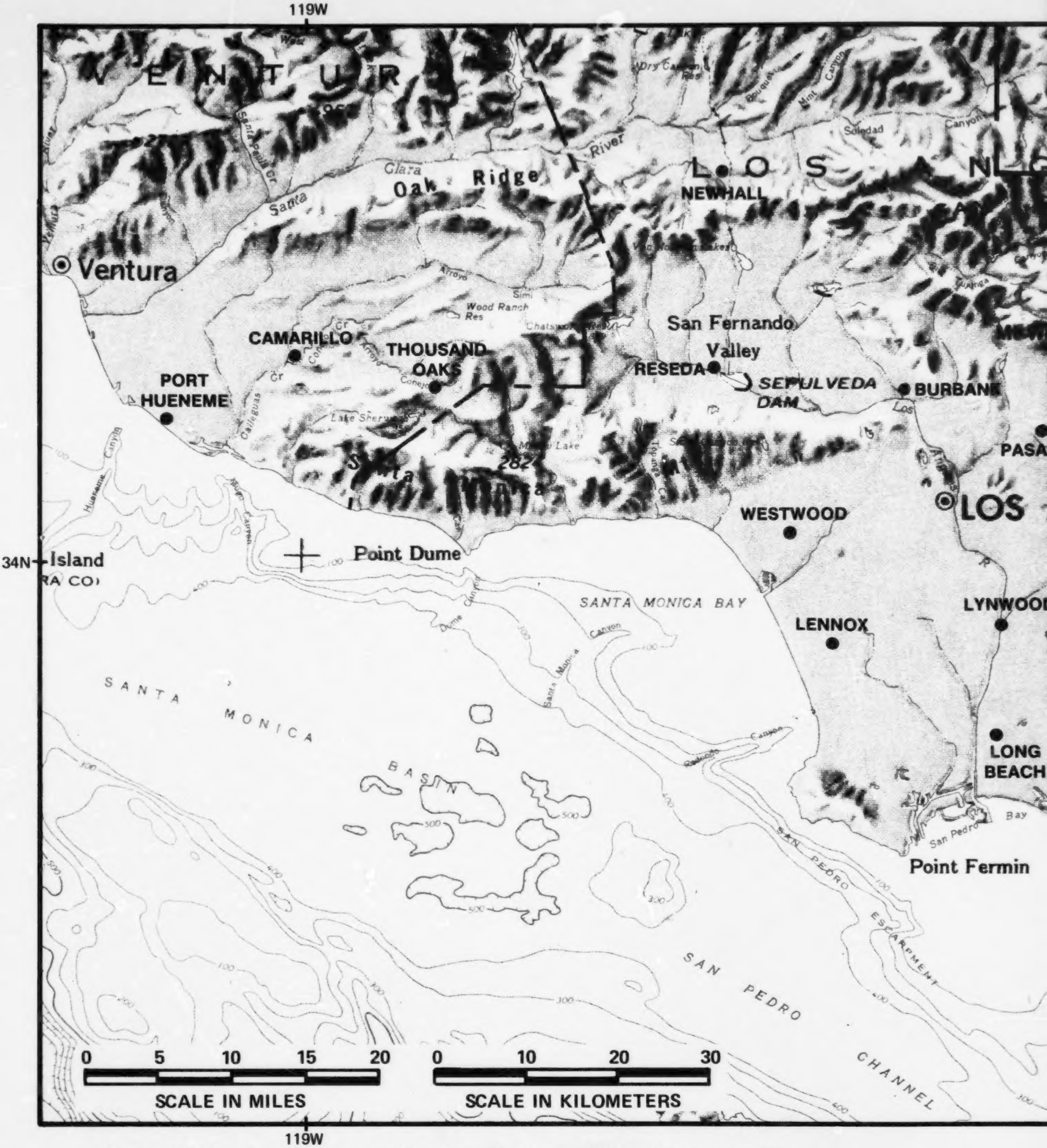
3136
Silverwood
5335
Arrowhead
BURBANK
Mt Wilson 5710
Cogswell Res 2385
San Gabriel Reservoir
Mt 64
San Antonio
San Antonio Res
SAN BERNARDINO
AZUSA
LOS ANGELES
LOS ANGELES
WHITTIER NARROWS DAM
Chino Cr
34N
RIVERSIDE
River
Prado Flood Control Basin
ANAHEIM
LONG BEACH
Santa Ana
San Gabriel
Lake Mathews
COLORADO RIVER
Lake Perris
Santiago Res
SANTA ANA
ORANGE
Railroad Canyon Res
Lake Elsinore
Bay
San Pedro
Point Fermin
San Diego Cr
Newport Bay
Trabuco
ESCARPMENT
100
200
300
CHANNEL
Dana Point

198P-94


119W
VENTURA
Ventura
Santa Clara River
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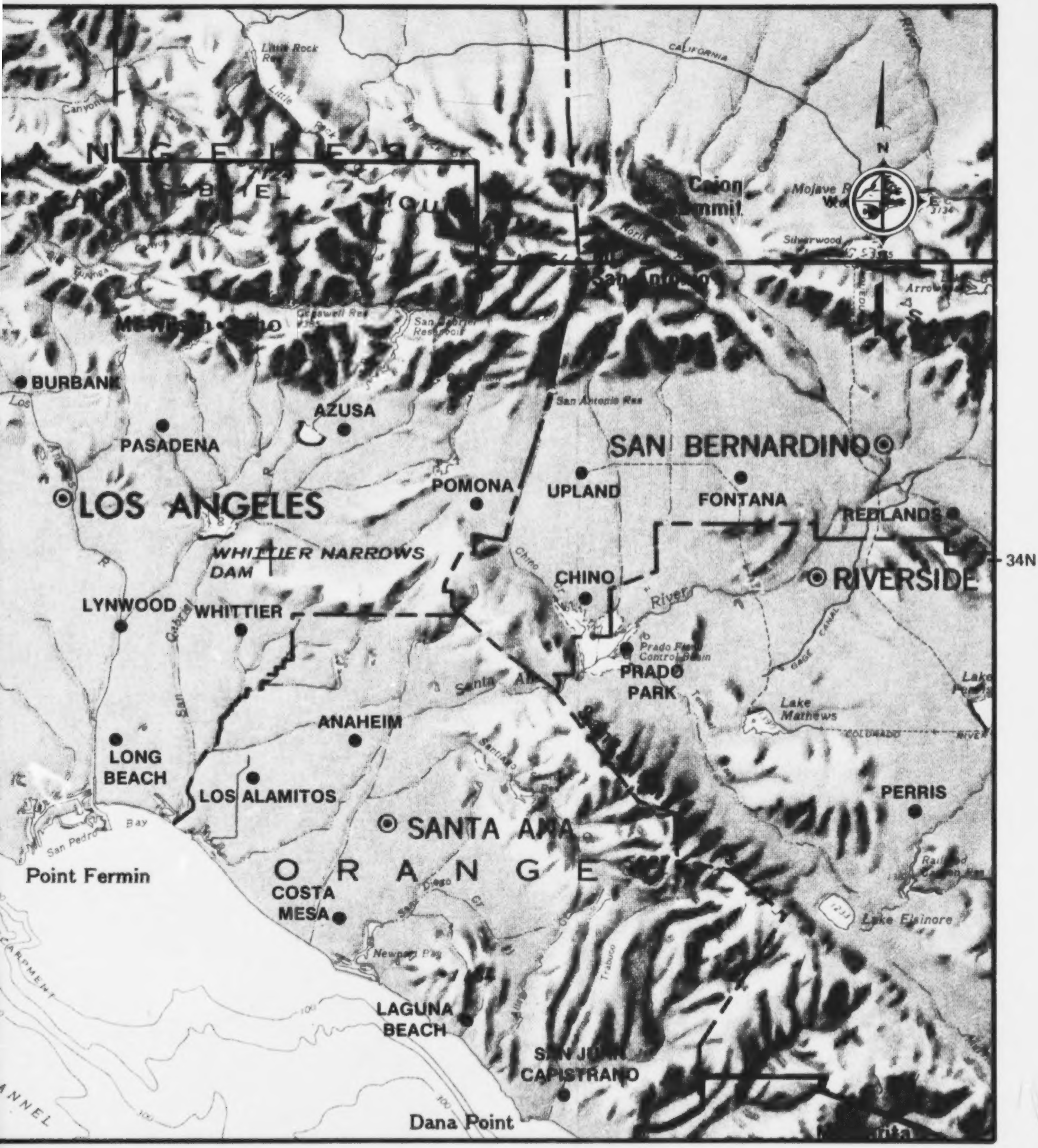
Wood Ranch Res
CAMARILLO
PORT HUENEME
THOUSAND OAKS
Lake Sherwood
Santa Monica
LOS ANGELES
NEWHALL
San Fernando Valley
RESEDA
SEPULVEDA DAM
BURBANK
PASA
LOS
WESTWOOD
Point Dume
34N
Island
SANTA MONICA BAY
LENNOX
LYNWOOD
LONG BEACH
San Pedro Bay
Point Fermin
SANTA MONICA BASIN
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
0
5
10
15
20
SCALE IN MILES
0
10
20
30
SCALE IN KILOMETERS
119W

Figure II-31. Air quality monitoring stations within the South Coast Air Basin.



Little Rock Res
Little Rock
Canyon
CALIFORNIA
N
Cajon Summit
Mojave R
Silverwood
San Antonio
Arrowhead
Mt Wilson
Cogswell Res
San Gabriel Reservoir
BURBANK
AZUSA
PASADENA
San Antonio Res
SAN BERNARDINO
LOS ANGELES
POMONA
UPLAND
FONTANA
REDLANDS
34N
WHITTIER NARROWS DAM
Chino
CHINO
RIVERSIDE
LYNWOOD
WHITTIER
River
Prado Flood Control Basin
PRADO PARK
Santa Ana
Lake Mathews
COLORADO RIVER
ANAHEIM
LONG BEACH
LOS ALAMITOS
PERRIS
Bay
San Pedro
SANTA ANA
Point Fermin
ORANGE
COSTA MESA
Lake Elsinore
Newport Bay
Trabuco
LAGUNA BEACH
SAN JUAN CAPISTRANO
Dana Point

198P-95

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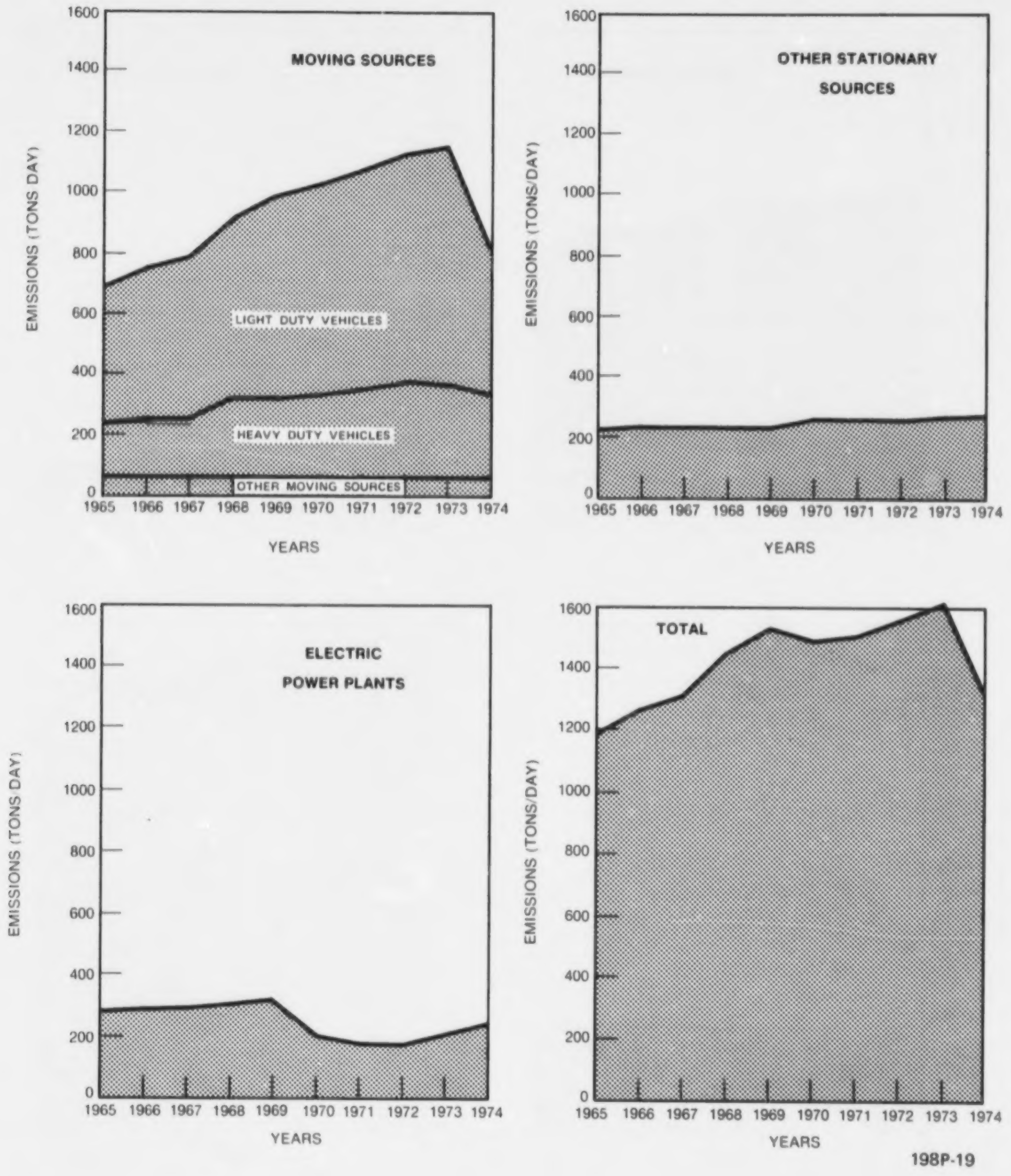

Figure II-32. South Coast Air Basin trends in oxides of nitrogen emissions (Trijonis et al., 1976).

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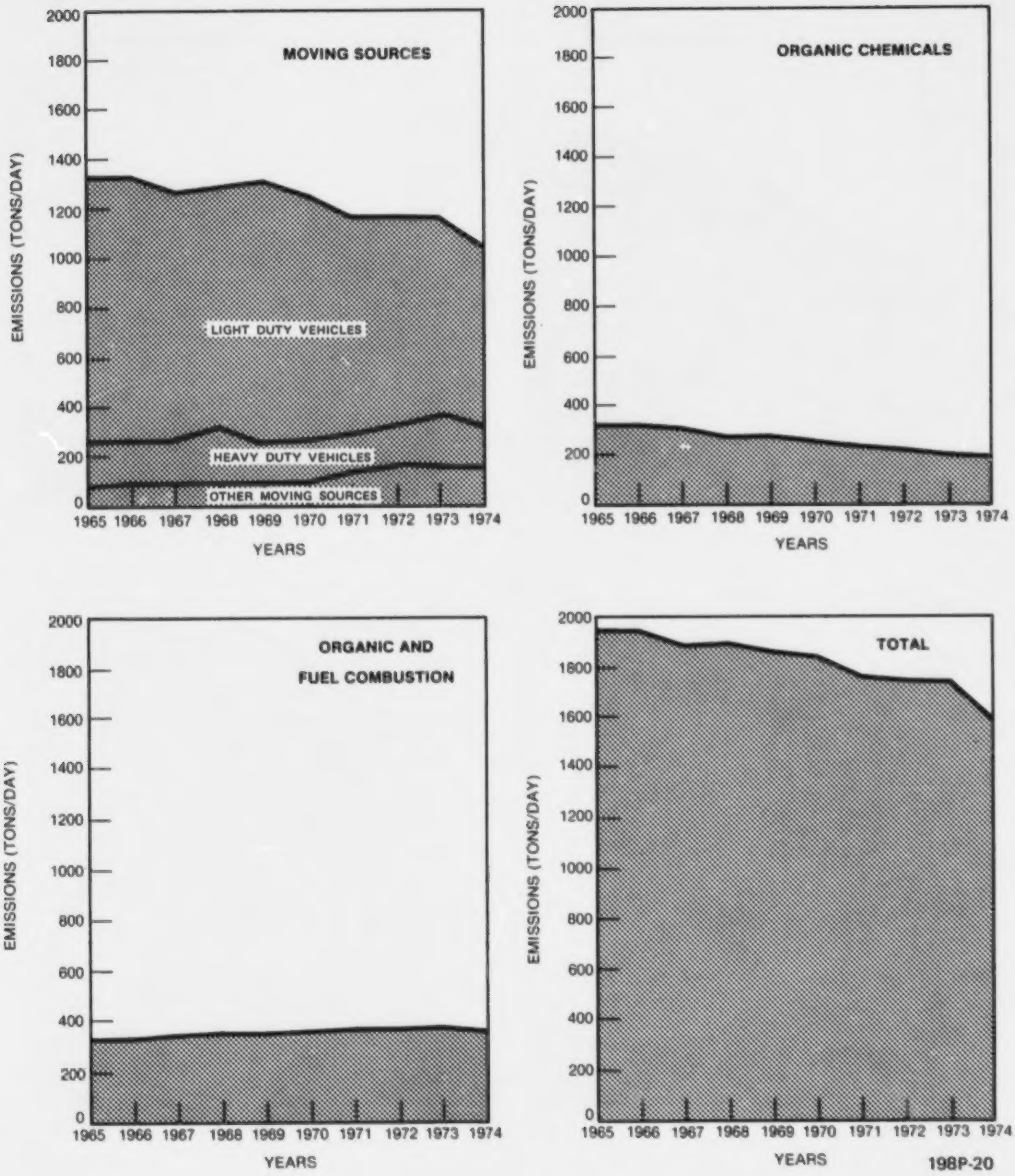


Figure II-33. South Coast Air Basin trends in reactive hydrocarbon emissions (Trijonis et al., 1976).

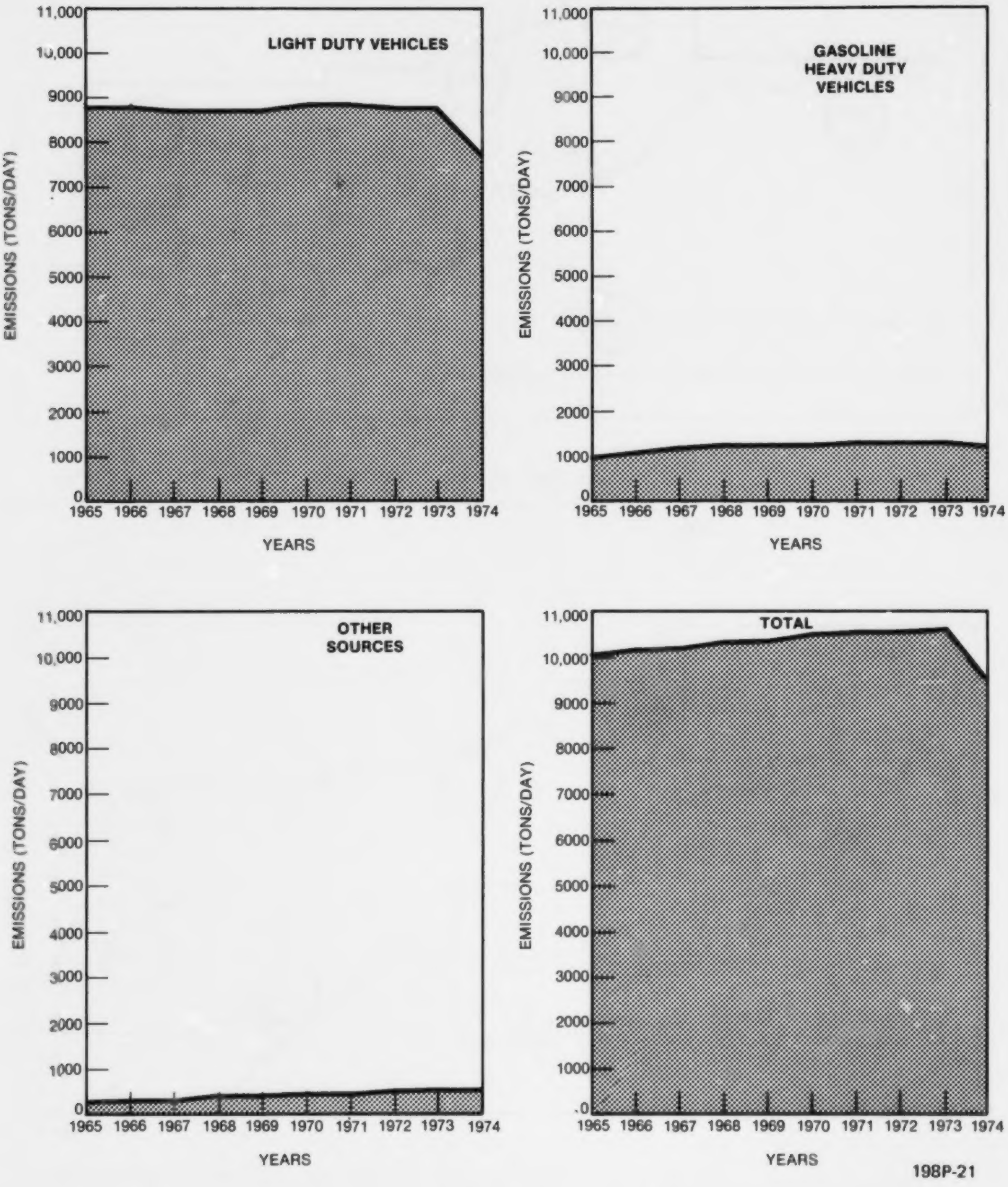
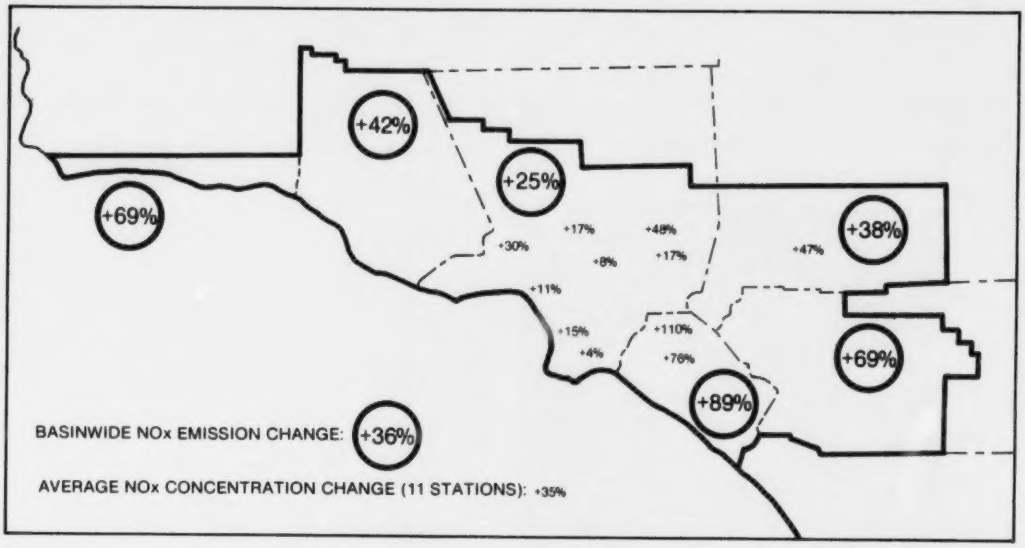


Figure II-34. South Coast Air Basin trends in carbon monoxide emissions (Trijonis et al., 1976).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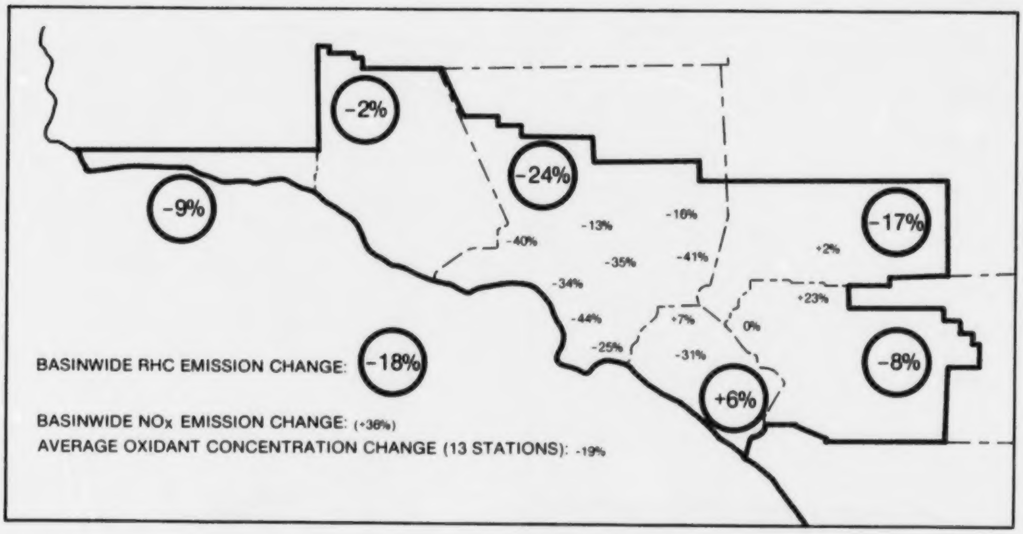
+76%
+69%
+89%
BASINWIDE NOx EMISSION CHANGE: +36%
AVERAGE NOx CONCENTRATION CHANGE (11 STATIONS): +35%

Figure II-35. South Coast Air Basin trends in oxides of nitrogen emissions and air quality, 1965-1974 (Trijonis et al., 1976).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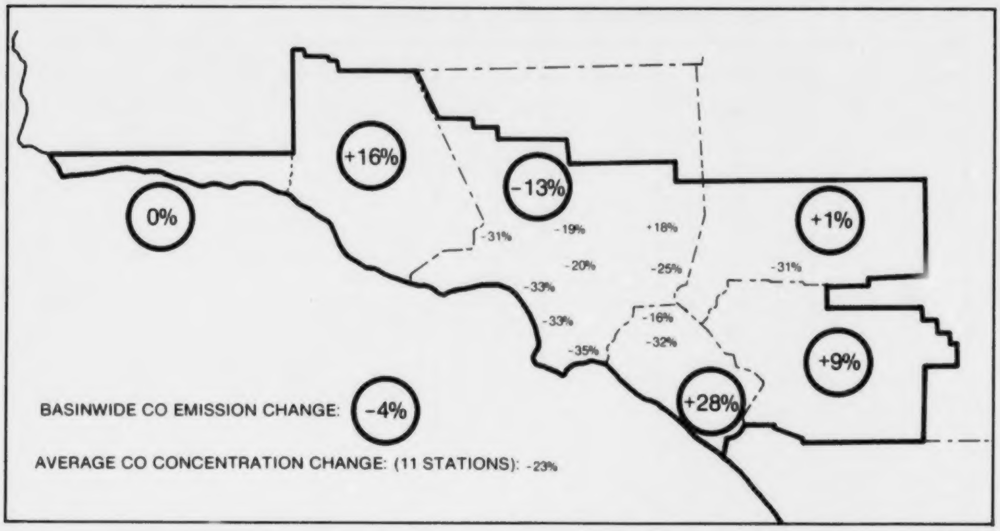
-31%
-8%
+6%
BASINWIDE RHC EMISSION CHANGE: -18%
BASINWIDE NOx EMISSION CHANGE: (+36%)
AVERAGE OXIDANT CONCENTRATION CHANGE (13 STATIONS): -19%

198P-97

Figure II-36. South Coast Air Basin trends in reactive hydrocarbons emissions and oxidant air quality, 1965-1974, (Trijonis et al., 1976).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-16%
-32%
-35%
+9%
+28%
BASINWIDE CO EMISSION CHANGE: -4%
AVERAGE CO CONCENTRATION CHANGE: (11 STATIONS): -23%
198P-98

Figure II-37. South Coast Air Basin trends in carbon monoxide emissions and air quality, 1965-1974 (Trijonis et al., 1976).

in 1971 with 0.53 ppm and the second highest in Azusa in 1972, where 0.51 ppm was recorded. The high for 1974, the year chosen as the baseline for this report, occurred at Upland with a value of 0.50 ppm.

In general, 1971 and 1973 exihibited lower oxidant values overall with 1972 and 1974 generally higher. Although some relatively large percentage changes do occur in the oxidant maxima from year to year, the irregularity of the changes coupled with the short record period make trend analysis difficult. The 1974 maximum values of oxidant are lower than the 1971 values, with Burbank and Downtown Los Angeles countering the trend of the other stations.

For NO_2 the trend is slightly downward (i.e., lower maxima and fewer days over standards) with Azusa and West Los Angeles going the other way. The CO air quality changes, as reflected in the fair number of stations reporting no days with measured concentrations exceeding the federal standard, are also favorable from 1971 to 1974. Sulfur Dioxide shows no problems with most stations reporting no days over either the state or federal limits.

In Table II-10, hydrocarbon measurements are total hydrocarbons and where available are listed as parts per million. Tabulation of days over the federal standard of 0.24 ppm for the three-hour periods from 6 to 9 a.m. are given only for those stations with summary data.

Table II-10. Summary of air quality data for South Coast Air Basin (selected stations), 1971-1974.

STATION	YR	OZONE			CO		NO_2		SO_2			PARTICULATES				HC	
		M[1]	F[2]	S	M	F	M	S	MD	F	S	M	X	FP	SP	M	F
Anaheim	71	0.33	74	64	24	16	0.55	14	0.15	-	-	294	87	1	36	22	-
	72	0.27	80	60	34	50	0.33	6	0.16	-	-	257	103	0	50	18	-
	73	0.25	87	70	22	34	0.49	12	0.13	-	-	345	98	1	47	-	-
	74	0.20	56	45[3]	17	10	0.37	13	0.08	0	0[3]	223	95	0	43	20	194
Azusa	71	0.50	205	197	20	15	0.37	13	0.09	0	0	418	151	8	75	19	-
	72	0.51	199	189	14	6	0.44	15	0.11	0	0	342	150	8	86	15	-
	73	0.48	180	166	13	4	0.32	12	0.09	0	5	230	121	8	67	12	163
	74	0.40	206	132	15	3	0.45	14	0.11	0	0	242	106	0	70	12	182
Burbank	71	0.32	165	153	32	111	0.53	75	0.07	0	0	-	-	-	-	19	-
	72	0.21	155	131	32	116	0.49	27	0.08	0	0	-	-	-	-	19	-
	73	0.30	143	101	27	107	0.38	28	0.10	0	3	-	-	-	-	15	269
	74	0.36	168	146	37	119	0.35	19	0.12	0	0	-	-	-	-	20	281
Lennox	71	0.22	41	50	49	91	0.43	27	0.50	0	1	283	154	49	92	21	-
	72	0.18	20	11	49	144	0.39	17	1.00	0	1	303	137	3	92	17	-
	73	0.25	18	7	43	0	0.39	16	0.28	0	0	302	124	3	89	15	323
	74	0.16	9	7	46	7	0.43	14	0.17	0	0	230	117	0	80	18	269
Long Beach	71	0.28	39	29	41	54	0.46	32	0.35	0	1	-	-	-	-	-	-
	72	0.18	16	13	27	0	0.35	36	0.37	0	0	-	-	-	-	-	-
	73	0.21	12	6	20	0	0.35	20	0.28	0	0	-	-	-	-	-	-
	74	0.18	20	13	24	0	0.37	21	0.34	0	0	-	-	-	-	-	-
Los Angeles Downtown	71	0.25	118	92	30	108	0.74	70	0.11	0	0	304	162	3	86	12	-
	72	0.26	138	13	34	104	0.39	44	0.12	0	0	302	130	3	78	15	-
	73	0.54	117	79	29	75	0.58	16	0.12	0	6	412	114	4	67	9	263
	74	0.26	144	127	30	89	0.64	33	0.08	0	6	286	97	2	56	9	254
Los Angeles West	71	0.27	93	59	34	32	0.60	32	0.11	0	0	-	86	-	-	-	-
	72	0.20	66	51	34	73	0.42	26	0.17	0	0	-	86	-	-	-	-
	73	0.40	90	43	29	0	0.47	24	0.10	0	0	230	74	0	18	-	-
	74	0.20	75	51	35	0	0.76	33	0.09	0	0	190	69	0	11	-	-
Pasadena	71	0.53	204	176	39	35	0.55	33	0.10	0	0	240	106	0	54	11	-
	72	0.28	81	192	27	43	0.43	24	0.07	0	0	205	110	0	92	11	-
	73	0.47	178	158	33	0	0.33	7	0.07	0	0	625	101	1	59	11	254
	74	0.35	214	190	33	0	0.47	18	0.06	0	0	224	80	0	40	10	253
Pomona	71	0.36	154	143	23	15	0.40	14	0.08	0	0	-	-	-	-	11	-
	72	0.38	164	151	22	70	0.43	13	0.09	0	0	-	-	-	-	8	-
	73	0.33	166	138	17	0	0.36	5	0.08	0	0	-	-	-	-	7	241
	74	0.32	160	150	17	0	0.34	7	0.07	0	0	-	-	-	-	7	223
Reseda	71	0.33	167	153	37	122	0.38	24	0.08	0	0	-	115	-	-	16	-
	72	0.30	157	136	37	100	0.42	22	0.05	0	0	-	143	-	-	16	-
	73	0.29	160	124	36	74	0.37	10	0.07	0	0	556	103	7	58	12	245
	74	0.29	175	155	31	63	0.34	8	0.07	0	0	207	84	0	37	12	202
Riverside	71	0.44	220	140	30	171	0.38	6	0.09	0	0	384	137	15	76	12	-
	72	0.39	158	180	25	97	0.16	0	0.06	0	0	359	136	7	73	12	-
Rubidoux	73	0.30	190	177	13	0	0.10	-	0.04	0	0	370	-	-	-	16	-
	74	0.31	200	163[4]	14	0	0.20	-	0.03	0	0	420	136	19	70	15	-
Ventura	71	-	-	-	-	-	-	-	-	-	-	152	73	3	17	-	-
	72	-	-	-	-	-	-	-	-	-	-	218	65	0	8	-	-
	73	0.16	74	-	-	-	-	-	-	-	-	181	73	0	27	-	-
	74	0.16	87	-	9	0	0.20	5	0.01	0	0[5]	173	76	0	19	-	-
Whittier	71	0.40	124	106	45	33	0.53	17	0.15	0	0	-	-	-	-	17	-
	72	0.30	104	-	32	91	0.62	35	0.25	0	0	-	-	-	-	15	-
	73	0.29	90	55	28	0	0.48	12	0.28	0	0	-	-	-	-	11	285
	74	0.30	84	75	26	0	0.40	9	0.18	0	0	165	87	0	38	15	298

[1] Ozone levels have been adjusted (Los Angeles County x 1.04; others x 0.78).

[2] Estimated.

[3] Telecon with Mr. Kay, 12 February 1976.

[4] Telecon with Mr. Hernandez, 12 February 1976.

M = Maximum high hour concentration (ppm or $\mu g/m^3$)

F = Number of days federal standards exceeded (primary)

S = Number of days state standards exceeded (primary)

X = Annual geometric mean concentration ($\mu g/m^3$)

MD = Maximum 24 hour (single hour) (ppm)

FP = Percent of samples exceeding 260 $\mu g/m^3$

SP = Percent of samples exceeding 100 $\mu g/m^3$

Table II-11. Ambient air quality standards applicable in California.

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS CONCENTRATIONS	FEDERAL STANDARDS		BASIS FOR PRIMARY STANDARD
			PRIMARY	SECONDARY	
Photochemical Oxidants (Corrected for NO_2)	1 hour	0.10 ppm	0.08 ppm	Same as Primary Std.	Prevention of eye irritation and possible impairment of lung function in persons with chronic pulmonary disease.
Carbon Monoxide	12 hours 8 hours 1 hour	10 ppm -- 40 ppm	-- 9 ppm 35 ppm	Same as Primary Std.	Prevention of interference with oxygen transport by blood.
Nitrogen Dioxide	Annual Average 1 hour	-- 0.25 ppm	0.05 ppm --	Same as Primary Std.	Possible health effects could occur at slightly higher dosage. Produces atmospheric discoloration.
Sulfur Dioxide	Annual Average 24 hours 3 hours 1 hour	-- 0.04 ppm -- 0.50 ppm	0.03 ppm 0.14 ppm -- --	-- -- 0.05 ppm --	Prevention of increase in chronic respiratory disease on long-term exposure.
Suspended Particulate Matter	Annual Geometric Mean 24 hours	60 $\mu g/m^3$ 100 $\mu g/m^3$	75 $\mu g/m^3$ 260 $\mu g/m^3$	60 $\mu g/m^3$ 150 $\mu g/m^3$	Long continued exposure may be associated with chronic respiratory disease. Exposure to a combination of suspended particles and sulfur dioxide may produce acute illness.
Lead (Particulate)	30-day Average	1.5 $\mu g/m^3$	--	--	
Hydrogen Sulfide	1 hour	0.03 ppm	--	--	
Hydrocarbons (Corrected for Methane)	3 hours (6-9 a.m.)	0.25 ppm	0.24 ppm	Same as Primary Std.	
Visibility Reducing Particles	1 observation	Visibility to less than 10 miles when the relative humidity is less than 70%	--	--	
Sulfates (in Particulates)	24 hours	25 $\mu g/m^3$	--	--	

ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter

NOTES:

1. California standards are values that are not to be equaled or exceeded.
2. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once a year.

National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency (EPA).

National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.

c. Days Exceeding Standards. The number of days a pollutant measurement exceeds the established health standard is an accepted indicator of air quality. Figure II-38 shows the changes in number of days per month that the state oxidant standard (0.10 ppm averaged over an hour) was equaled or exceeded for the years 1958 (initial condition), 1963, and 1975 (SCAPCD, 1975). A similar data compilation for the federal standard (0.08 ppm) has not been published.

It is interesting to note the measurable reduction due to initial control efforts shown in the reduced number of days over the oxidant standard from November through February between 1958 and 1963. From 1963 to 1975, the improvement in the spring months as stronger control measures were instituted on vehicles is evident. Figure II-39 depicts the average number of days with an hourly maximum over established standards for the years 1971 through 1974 for each of thirteen air monitoring stations. Values are shown for oxidant, carbon monoxide, nitrogen dioxide and sulfur dioxide. Within the bars for oxidant and carbon monoxide is shown the maximum hourly value reached (in ppm) and whether the state or federal hourly concentration standards (Table II-11) were used.

The variation in number of days over the federal oxidant limit varies by about a factor of 10 (from 20 days at Long Beach and Lennox to over 200 at Azusa), reflecting the definite differences in air quality throughout the Basin. Although still evident, differences in days over the state

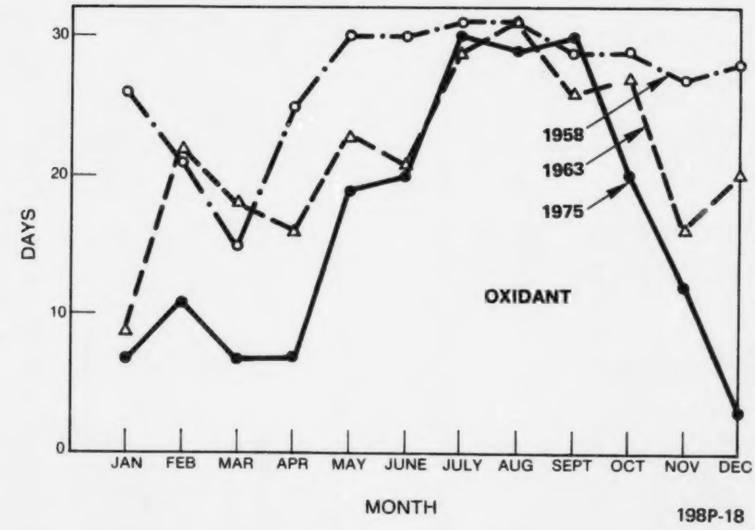


Figure II-38. Number of days the state standard for total oxidant was equaled or exceeded (1 hr avg = 0.10 ppm) in the Los Angeles Basin (SCAPCD, 1975).

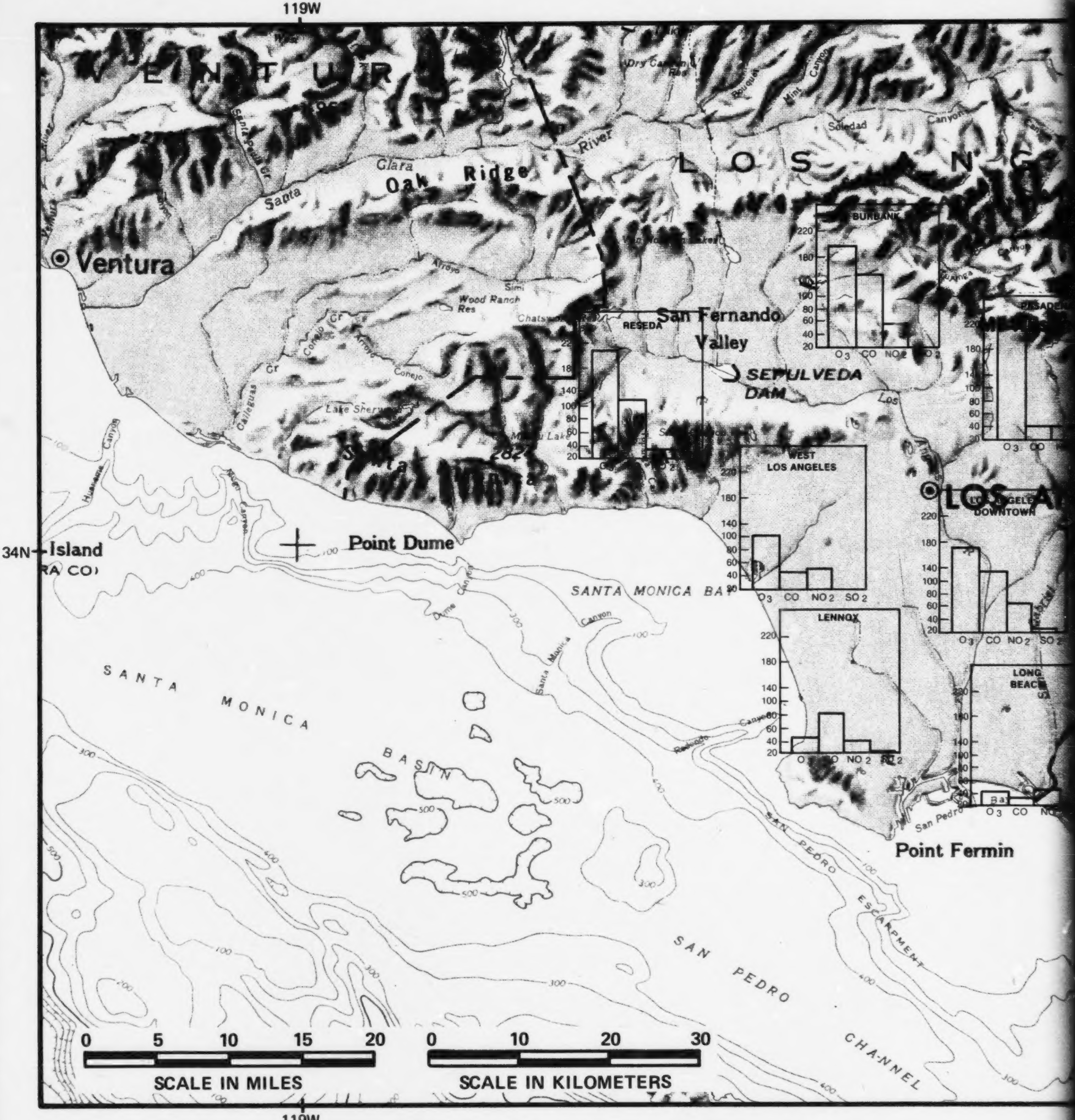
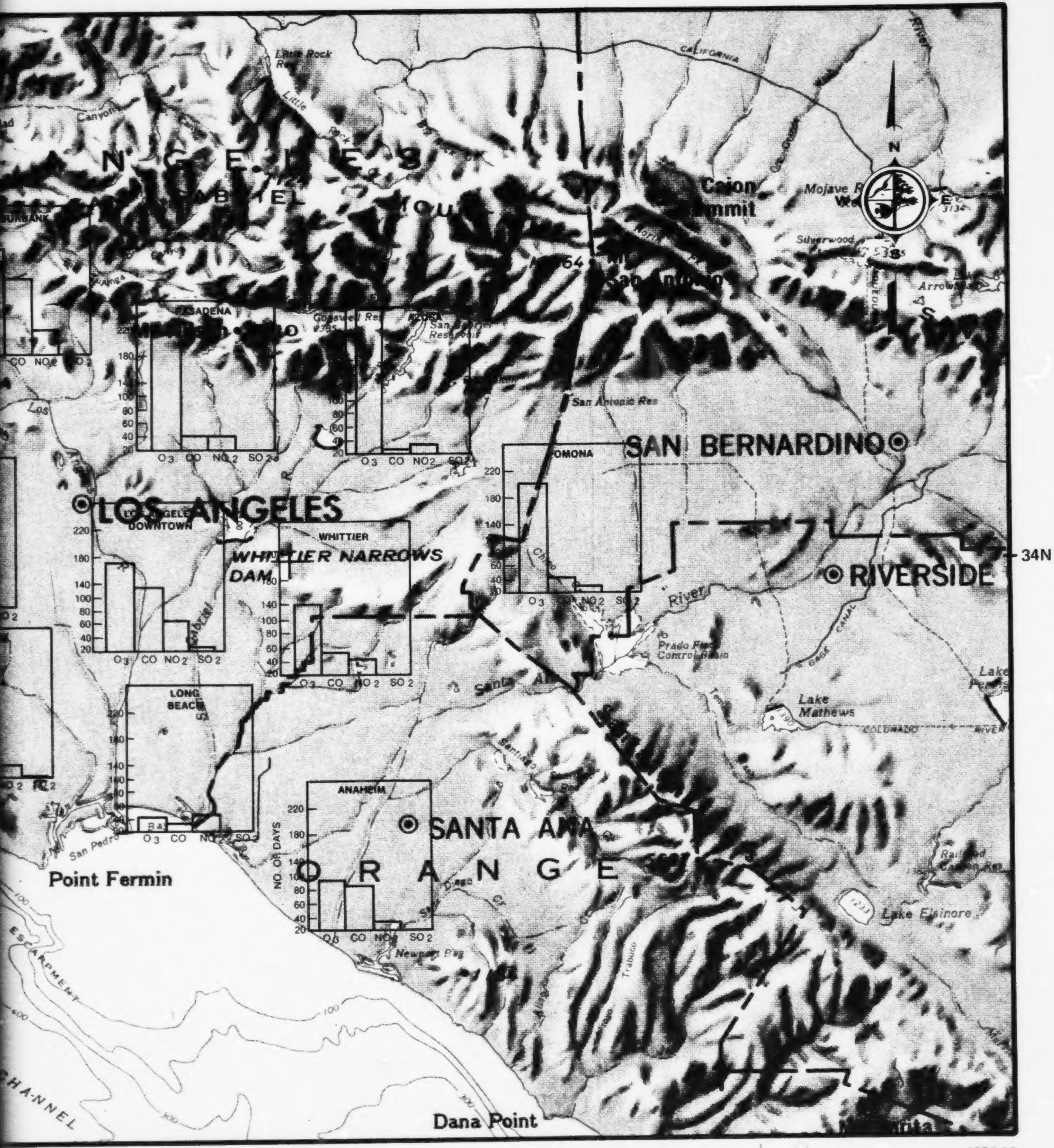

119W
V E N T U R
L O S A N G
Ventura
Santa Clara River
Oak Ridge
Simi
Wood Ranch Res
Arroyo
Conejo
Calleguas Cr
Lake Sherwood
Soledad Canyon
Dry Canyon Res
Bouquet
Mint Canyon
San Fernando Valley
SEPULVEDA DAM
Los
RESEDA
BURBANK
PASADENA
WEST LOS ANGELES
LOS ANGELES DOWNTOWN
LENNOX
LONG BEACH
220
180
140
100
80
60
40
20
O_3
CO
NO_2
SO_2
LOS A
34N
Island
Point Dume
SANTA MONICA BAY
Dume Canyon
Santa Monica Canyon
Redondo Canyon
SANTA MONICA BASIN
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
San Pedro
Point Fermin
100
300
400
500
0 5 10 15 20
SCALE IN MILES
0 10 20 30
SCALE IN KILOMETERS
119W

Figure II-39. Average number of days selected monitoring stations exceeded state or federal standards for the years 1971 through 1974.



Little Rock Res
Little Rock
Canyon
CALIFORNIA
N
E
S
ANGELES
GABRIEL MOUNTAINS
BURBANK
Cajon Summit
Mojave R
Silverwood
San Antonio
Arrowhead
PASADENA
Mt Wilson
Cogswell Res
AZUSA
San Gabriel Res
San Antonio Res
SAN BERNARDINO
POMONA
LOS ANGELES
LOS ANGELES DOWNTOWN
WHITTIER
WHITTIER NARROWS DAM
RIVERSIDE
34N
River
Prado Flood Control Basin
Lake Mathews
COLORADO RIVER
Lake Perris
LONG BEACH
ANAHEIM
SANTA ANA
ORANGE
NO. OR DAYS
San Pedro
Point Fermin
ESCARPMENT
CHANNEL
Newport Bay
Trabuco
Lake Elsinore
Railroad Canyon Res
Dana Point
20
40
60
80
100
140
180
220
O3
CO
NO2
SO2

198P-99

1 p.

nitrogen dioxide standard of 0.25 ppm are less dramatic, differing by a factor of three from Long Beach to Burbank. Carbon monoxide seems to be an oddity even here as it varies from nearly zero days to over 100 at several stations during the four years of data examined (Table II-10). It also seems to vary irregularly from place to place within the air basin during any year. Evidence such as this irregular behavior tends to indicate that there may be some problems with measurements, instrument exposure, or both for this particular contaminant. Although shown in the diagram, sulfur dioxide data is not felt to be indicative of a problem based on the present state standards.

Figure II-40 shows 1970 and 1975 oxidant data for Burbank, Reseda, Pasadena, Los Angeles, Whittier, and Long Beach. Except for Los Angeles and possibly Reseda, some improvement is seen, although that shown for Burbank and Pasadena is not too impressive. Generally the spring and fall months show a downward shift in days over standards with the summer months varying little. Nearly every day in the summer months shows at or over the 0.10 ppm oxidant value for the inland stations. Whittier shows a large drop in number of days over the standard, which is probably not due to control strategy, but may reflect a change in air quality due to meteorology or possibly a change in sampler location between the years 1970 and 1975. Long Beach shows the expected low oxidant occurrences found in coastal locations. It is worth noting that both Whittier and Long Beach for all their low numbers of days over the standard are still far from reaching the desired "one occurrence per year" goal established for air quality.

Although the above data is encouraging and indicates air quality improvement, the goal of less than one day a year exceeding the standard seems remote. Designation of the Los Angeles Basin as an Air Quality Maintenance Area and the establishment of an Air Quality Maintenance Plan (California Air Resources Board, 1974; California Air Resources Board, September 1974) reflect the concern of the State Air Resources Board and the federal EPA that the federal standards for oxidant will not be attained by 1985 and maintained thereafter. The small change in NO_2 air quality, for example, is shown in Figure II-41. Although Trijonis et al. (1976) show an overall 20 percent increase in NO_2 concentration levels from 1965 through 1974, these data are strongly influenced by two stations, one in Orange County and one in San Bernardino County, which were not included in Figure II-41.

With the number of days NO_2 and NO_x concentration values have exceeded standards holding steady or increasing over the past ten years, it is difficult to relate the basinwide improvement in oxidant air quality in the fall, winter, and spring months as shown in Figure II-38 to either NO_2 or NO_x concentration levels. Table II-10 also shows that only slight changes in the maximum hourly average values for hydrocarbons occurred in the period 1971 to 1974 and that, where data on days over standards are shown, the tendency is still for over 200 days a year to exceed standards. These two comparisons point up the extreme complexity of the basin "smog" problem and indicate some of the difficulties in determining proper control measures.

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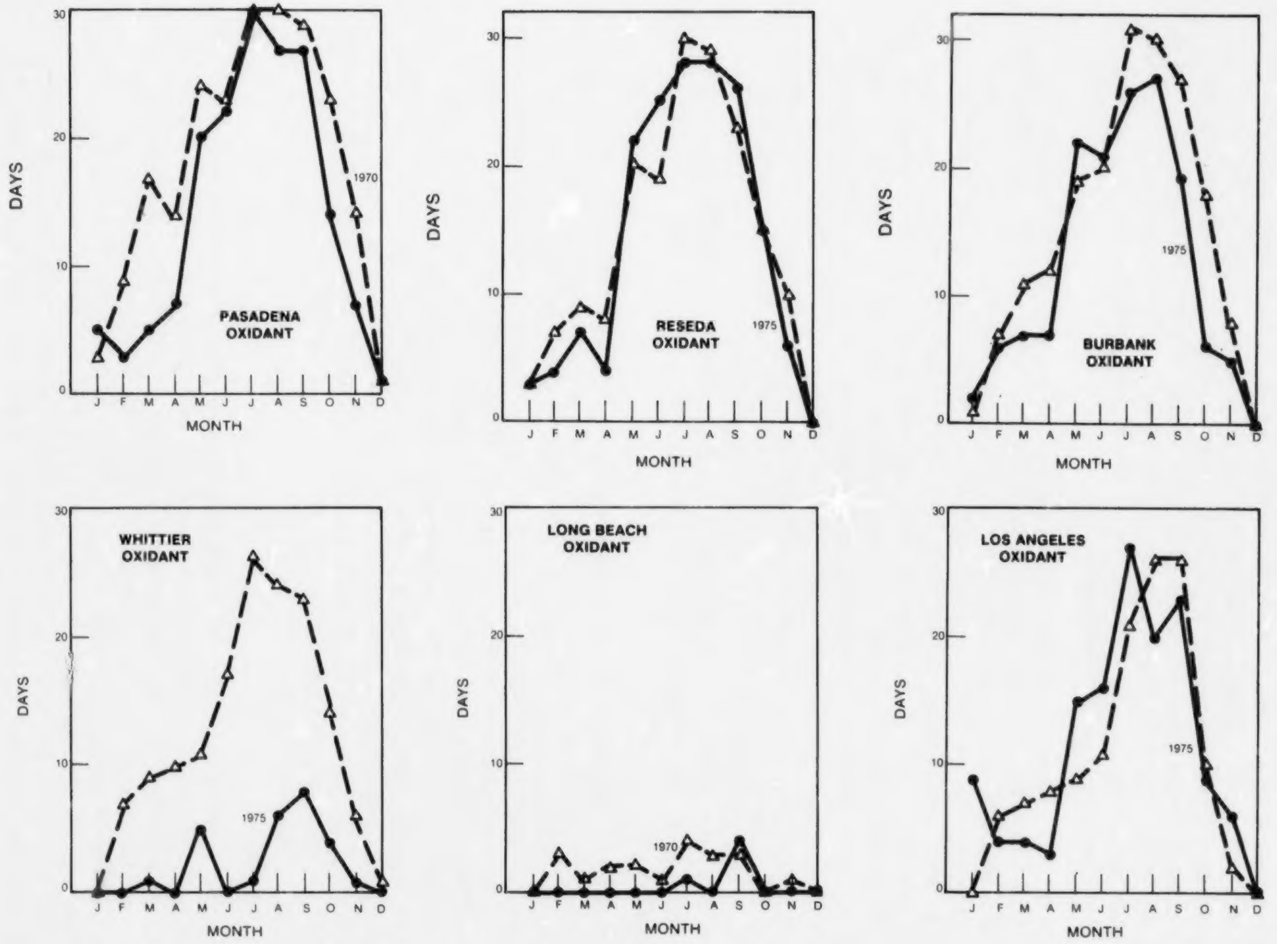

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Figure II-40. Number of days state standard for total oxidant (1 hr avg = 0.10 ppm) was equaled or exceeded in 1970 and 1975.

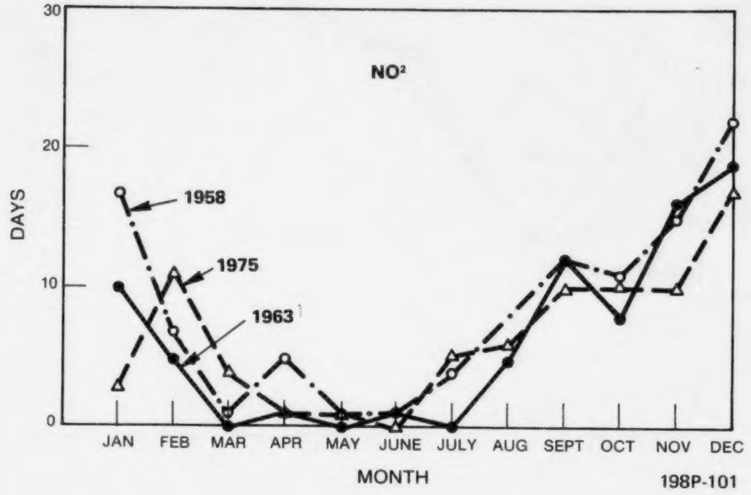


Figure II-41. Number of days in the South Coast Air Basin the state standard for nitrogen dioxide (1 hr avg = 0.25 ppm) was equaled or exceeded (SCAPCD, 1975).

d. Meteorological Indicators. The observed changes in oxidant are probably not the direct result of meteorological influences either. Figure II-42 shows the annual distribution of visibility for the years 1963 and 1975 and a composite curve of the lowest number of days exceeding the standard in any year. With 1975 tending to be the best visibility year on record, it is possible that the weather could have been more cooperative than usual in reducing oxidant in the months of March, April, October, November, and December, when the oxidant levels showed the most improvement. The fact that half or more of the days in each of these months still had visibilities below standards due to high particulate concentrations indicates that the air quality was not all that much improved. The conclusion that the decrease in days with oxidant levels over 0.10 ppm is due in large part to emission controls and not favorable weather can be drawn, since a change in meteorology would affect all pollutants similarly.

The particulate data in Table II-10 contribute in another way to the conclusion that weather favoring significant oxidant reductions did not occur during the period 1971 to 1974. The maximum particle concentrations and geometric mean concentrations do not, in general, show large or consistent decreases. With three possible exceptions (Lennox, Downtown Los Angeles, and Pasadena), the percentage of time that the particle concentrations exceeded the state standard of 100 $\mu g/m^3$ was about the same basinwide each year. This indicates about the same atmospheric dust content, humidity, average mixing depth, wind speed, and overall weather for the four years.

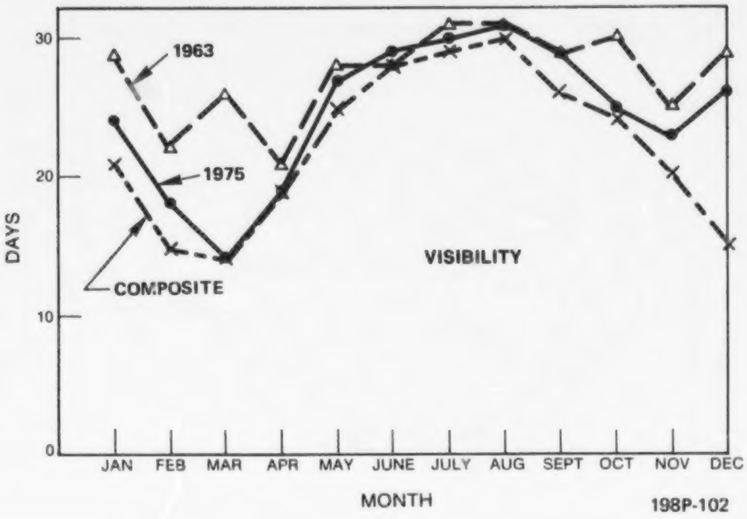


Figure II-42. Number of days in the South Coast Air Basin state standard for visibility (< 10 miles with relative humidity < 70%) was equaled or exceeded.

Another comparison is the number of days on which certain combinations of meteorological conditions occur that favor increased pollution levels—that is, inversion base below 1,500 feet, inversion mixing heights (top) less than or equal to 3,500 feet, and a surface wind of less than 5 miles per hour (Rule 444, SCAPCD). Figure II-43 shows the occurrence of such days for 1958, 1963, and 1975. The similarity in frequency distribution for each year is striking, but more important is the upward trend in unfavorable days in the winter months. That these meteorological indicators with relatively consistent distribution patterns show a tendency for poorer air quality while the air quality was actually showing definite improvements leads to the conclusion that these air quality improvements are not due to favorable meteorology.

e. Emissions Inventory Projections. The previous discussion has considered already existing data and shown that the air quality throughout Los Angeles and South Coast Air Basins is relatively grossly determined. Ten-year trends can be seen in some emissions levels, and air quality as represented by oxidant level seems to be improved. Other pollutants such as carbon monoxide, oxides of nitrogen, and reactive hydrocarbons show less clear trends. Average concentration differences between monitoring stations in the same year and from one year to another at the same station are relatively large.

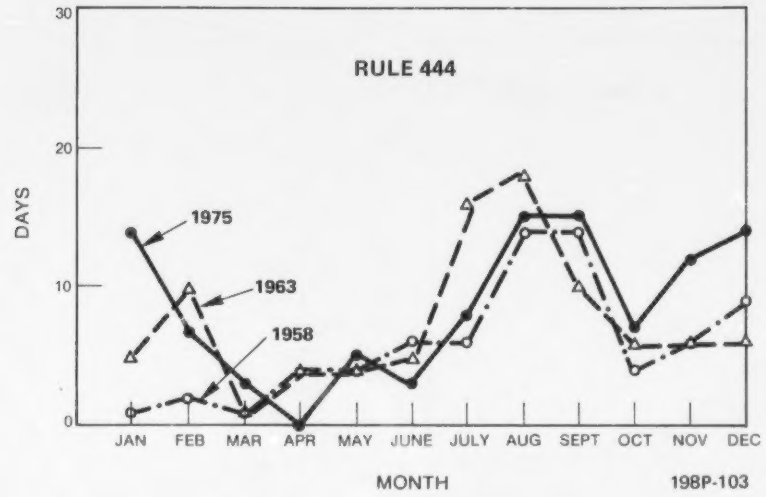


Figure II-43. Number of days all Rule 444 factors were attained (SCAPCD, 1975).

The projected emissions under present control schemes should continue to decrease in the near term (Trijonis et al., 1976), but the rate is hard to establish. A possibility exists that with expected traffic increases, the use of fuels other than natural gas, and increasing population densities in some areas of the Basin, only slight improvement in air quality will occur. Most projections are not that pessimistic, but the problem is real and careful consideration in any planning of new facilities is indicated.

One of the most recent projections of emission levels for future years has been done by the California Air Resources Board (ARB, 1976A, 1976B). Trend lines for reactive organic gas emissions (hydrocarbons), oxides of nitrogen, and carbon monoxide from 1973 through the year 1990 are given in Figures II-44 through II-46. The rise in all emissions after the 1980-1985 time frame is obvious. Table II-12 provides details of the emissions inventories for 1974 and 1990, extracted from preliminary data tables of the California Air Resources Board (March 1976).

f. Air Quality Projections for the Service Area. Recent contact with the Air Resources Board indicates that the projections given in Table II-12 are valid, although some elements may be too high. Until they are revised, these data are the best available guide to future air quality conditions in the South Coast Air Basin.

The rate of increase indicated for stationary source emissions is a general trend derived from projected increases in economic activity in

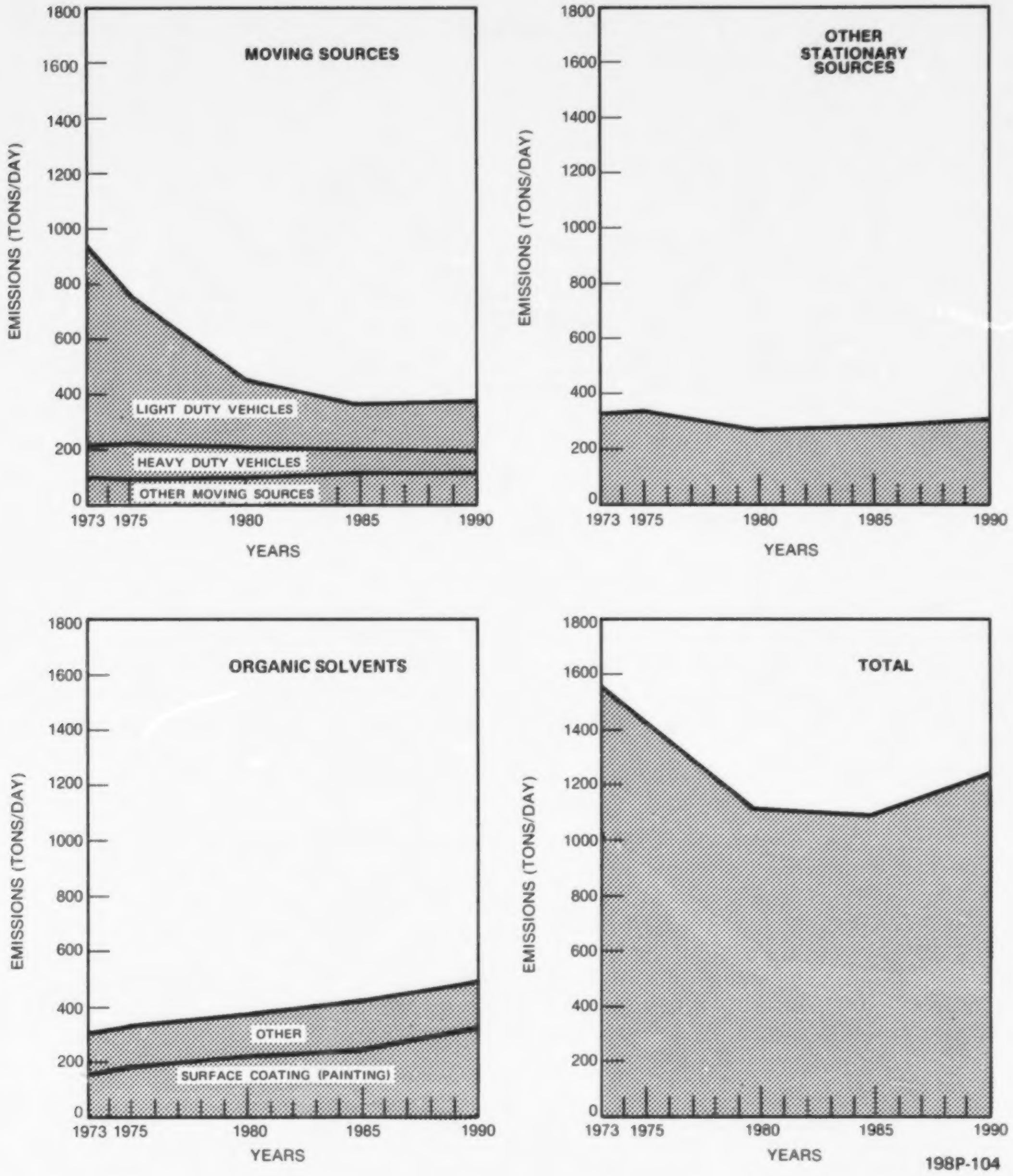


Figure II-44. South Coast Air Basin projected reactive hydrocarbon emissions (ARB, 1976).

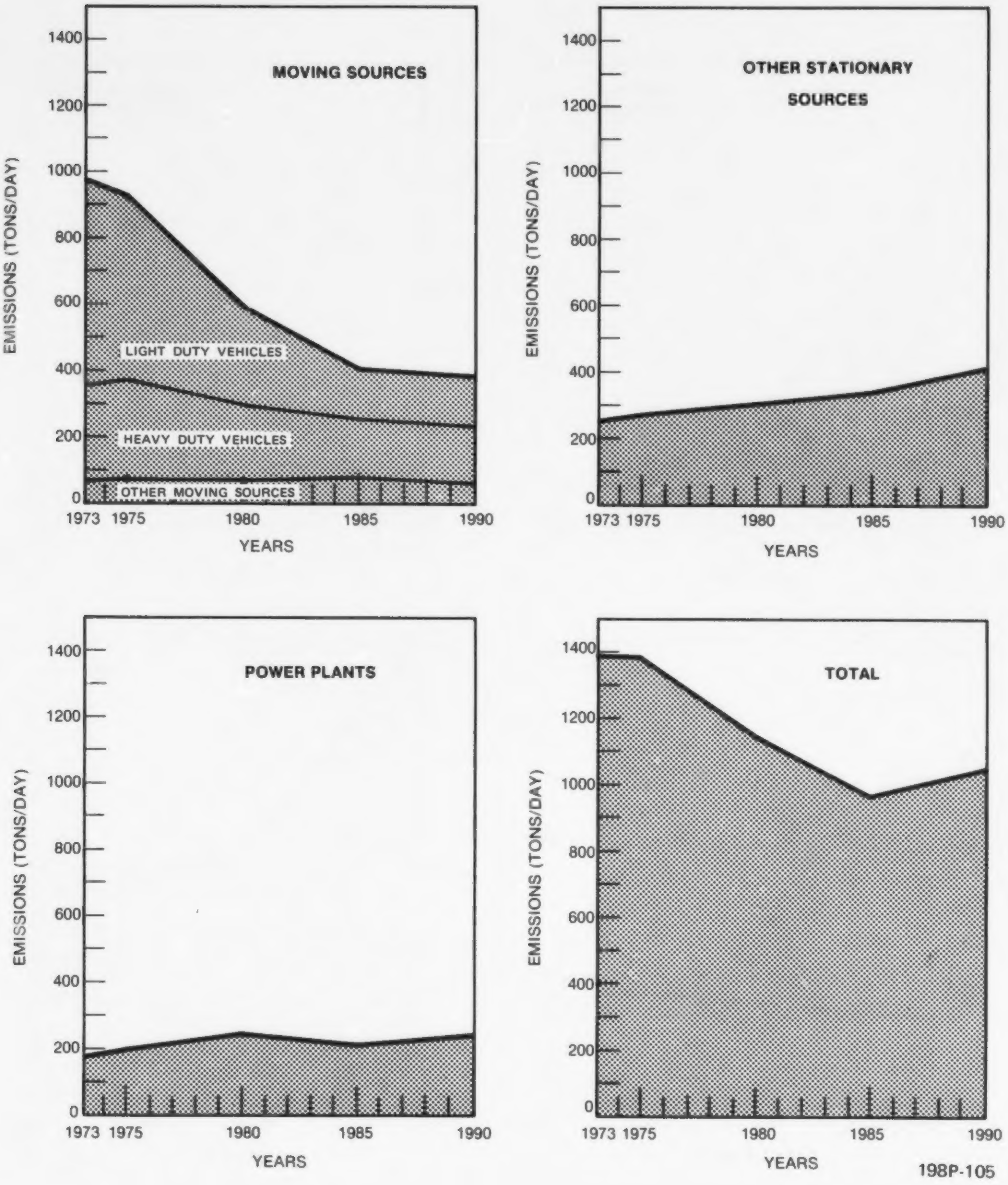


Figure II-45. South Coast Air Basin projected oxides of nitrogen emissions (ARB, 1976).

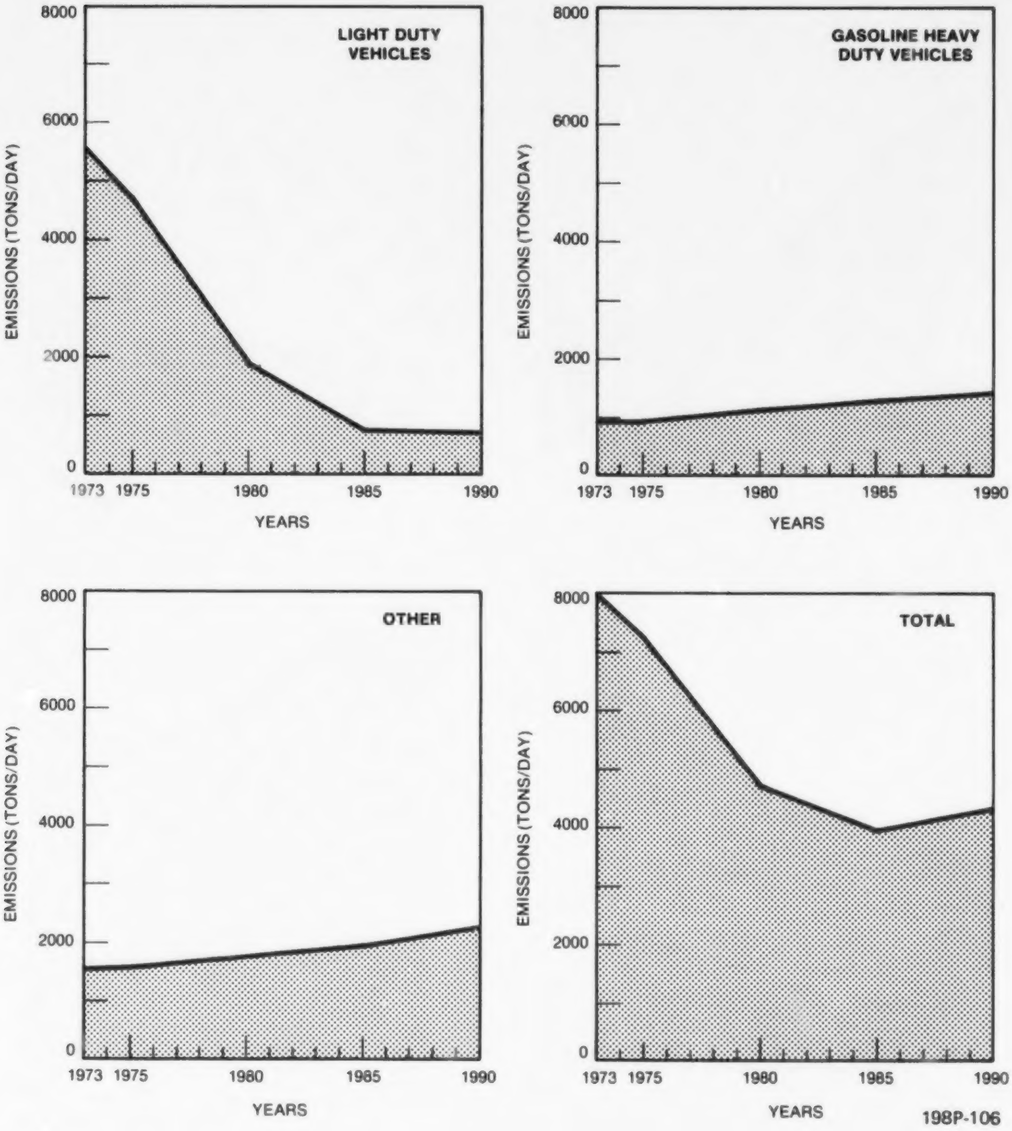


Figure II-46. South Coast Air Basin projected carbon monoxide emissions (California ARB, 1976A, 1976B).

Table II-12. South Coast Air Basin stationary source emissions inventory (ARB, 1976).

STATIONARY SOURCE	1974			1990		
	TOTAL HYDROCARBONS	RHC	NO_x	TOTAL HYDROCARBONS	RHC	NO_x
Petroleum Production	62.6	33.8	2.1	86.0	46.4	2.9
Refining	48.3	46.4	19.4	75.8	72.8	30.4
Marketing	168.5	160.1	10.0	70.4	66.9	3.8
Total	279.4	240.3	31.5	232.2	186.1	37.1
Organic Solvents						
Surface Coatings	170.5	163.7	-	341.0	327.4	-
Dry Cleaning	30.9	11.7	-	36.3	13.8	-
Degreasing	43.1	4.3	-	91.2	9.1	-
Other	177.5	133.1	-	192.0	144.0	-
Total	422.0	312.8	-	660.5	494.3	-
Chemical	3.7	3.7	0.5	11.6	11.6	1.3
Metallurgical	0.1	0.1	3.2	0.2	0.2	4.9
Mineral	2.4	0.8	6.1	3.9	1.4	10.1
Food & Agriculture						
Process	0.4	0.4	-	0.9	0.9	-
Pesticides	9.4	9.4	-	11.3	11.3	-
Wood Processing	-			-	-	-
Combustion of Fuels						
Power Plants	12.5	4.9	180.5	17.5	6.8	231.0
Other Industrial	11.5	4.6	140.5	22.6	9.0	286.0
Domestic/Commercial	1.5	0.6	62.9	2.1	0.9	72.9
Orchard Heaters	5.7	5.6	-	6.7	6.6	-
Total	31.2	15.7	383.9	48.9	23.3	589.9
Waste Burning	1.5	1.3	1.2	1.7	1.5	1.3
Miscellaneous Area Sources						
Wild Fires	15.6	8.1	0.7	15.6	8.1	0.7
Structural Fires	27.7	14.4	1.3	32.8	17.1	1.6
Utility Equipment	22.2	19.8	1.6	25.2	22.4	1.8
Total	65.5	42.3	3.6	73.6	47.6	3.1
Total	816	627	430	1045	778	648

the South Coast Air Basin through 1990. Reactive hydrocarbons from sources of organic solvent emissions such as surface coatings (paint) and miscellaneous other activities show increases that tend to outweigh emissions controls instituted for gasoline marketing. Increases in power plant emissions, pesticide use, chemical production, and other industrial emissions also contribute to the rising emissions trend for stationary source hydrocarbons. Oxides of nitrogen from power plants and industrial sources show large projected increases by 1990 with commercial and residential sources showing more moderate increases.

These stationary source rising trends are the controlling factor in the overall emissions rise in hydrocarbons and oxides of nitrogen after 1985 shown in Figures II-44 and II-45. The vehicle emissions show only small increases, if any, after that time with large decreases occurring between 1975 and 1985 for all vehicles. The emissions profile for carbon monoxide is shown in Figure II-46 and follows the same general trend.

The percentage of vehicle emissions compared to the total emissions in 1990 is much lower than it is in 1975 indicating in another way the increasing importance that stationary emissions control will play in the air quality control strategies in future years.

g. Summary of Existing Air Quality Effects.

(1) EFFECTS ON HUMAN HEALTH. The effect of air pollution on the human environment and particularly on human health is of primary concern in the study of air quality. A study on the health effects of ozone was recently completed as part of a California Air Resources Board (ARB) research program. The study showed that exposures to concentrations of 0.3 ppm or more of ozone for two hours or more (a condition which occurs occasionally in the South Coast Air Basin) with intermittent light exercise can have significant deleterious effects on health. Some persons thus exposed not only developed measurable physiological and biochemical changes but felt physically ill and were unable to perform their normal jobs during exposure and for several hours afterward. The most sensitive persons were generally those with history of asthma, allergy, or previous subjective adverse reactions to smog exposure. The least sensitive persons tested did not develop respiratory symptoms or physiological changes but did exhibit biochemical changes.

These findings related to relatively healthy, young to middle-aged adult men performing light exercise. Other groups—such as children, older adults, pulmonary disease patients, or workers performing heavy exercise—may be at risk at even lower ozone levels, the research study concluded.

The mechanism by which components of smog irritate the eyes is unknown; but in heavily polluted regions such as Los Angeles, 75 percent of the populace may experience eye irritation. As a defense, the tear glands may produce copious tears in an attempt to wash away the irritating agent. Many of the oxidants of photochemical smog cause eye irritation, particularly the PANs. Studies in Los Angeles have demonstrated that eye irritation increases over the range of instantaneous oxidant concentrations from 0.5 to 0.45 ppm although no clearly demarcated threshold level for this effect is apparent (EPA, 1976, *Photochemical Oxidants in the Ambient Air of the United States*).

The effects of sulfates (in aerosol form) upon human health have not been adequately defined. The federal EPA has stated that the "best judgment exposure threshold for adverse effects" for long-term (annual) exposure is 9 to 14 micrograms per cubic meter.

(2) EFFECTS ON PLANTS. Sulfur dioxide (SO_2) damages the leaves of some plants exposed to a sufficient concentration and dosage. Apparently a threshold does exist because plants exposed to only low concentrations are able to take in small amounts of SO_2 through the stomata and dispose of it without damage. The SO_2 tends to be oxidized to sulfates in the cells of the leaf. Concentrations above the threshold for a particular plant cause deterioration of the internal cells and leaf discoloration. Spinach, lettuce, and some other leafy vegetables are very sensitive as are cotton and alfalfa. Many other plants are moderately sensitive. Most plants display maximum sensitivity in sunlight when the stomata are open and the plants are engaged in strong physiological activity.

If air pollutant concentrations (particularly oxidants) are not reduced, economic losses to agricultural interests will continue to climb. The California Department of Food and Agriculture has estimated that air pollution caused $55.1 million worth of agricultural damage in the state in 1974. Of far greater concern is the fact that there are over 20 crops that can no longer be grown commercially in the South Coast Air Basin because of their susceptibility to damage by air pollution (ARB, 1976).

Photochemical oxidant air pollution generated in the urban areas of Southern California is now weakening and killing millions of valuable pines in the forests of the Angeles, San Bernardino, Cleveland, and Los Padres National Forests. Oxidant damage is evident in every major strand of yellow pine in the Angeles National Forest, and heavy damage is evident in the San Bernardino National Forest (Figure II-47). Ozone has been shown to be responsible for much of the damage. It causes premature aging and reduced photosynthetic capabilities which in turn reduces growth and wood production, according to a plant pathologist with the U.S. Forest Service (Williams, 1975). This decline in the health of the trees, in turn, is "contributing to increased fire hazards, insect and disease problems, and resulting in potential successional patterns of forest ecosystems that are unfavorable for optimum and necessary resource yields and utilization."

This problem has been found in the Sierra Nevadas among a variety of species. Ponderosa and Jeffrey pine of the Sequoia and Kings Canyon National Parks are affected by oxidants formed from emissions of hydrocarbon and oxides of nitrogen. Williams concludes that low elevation forests on the

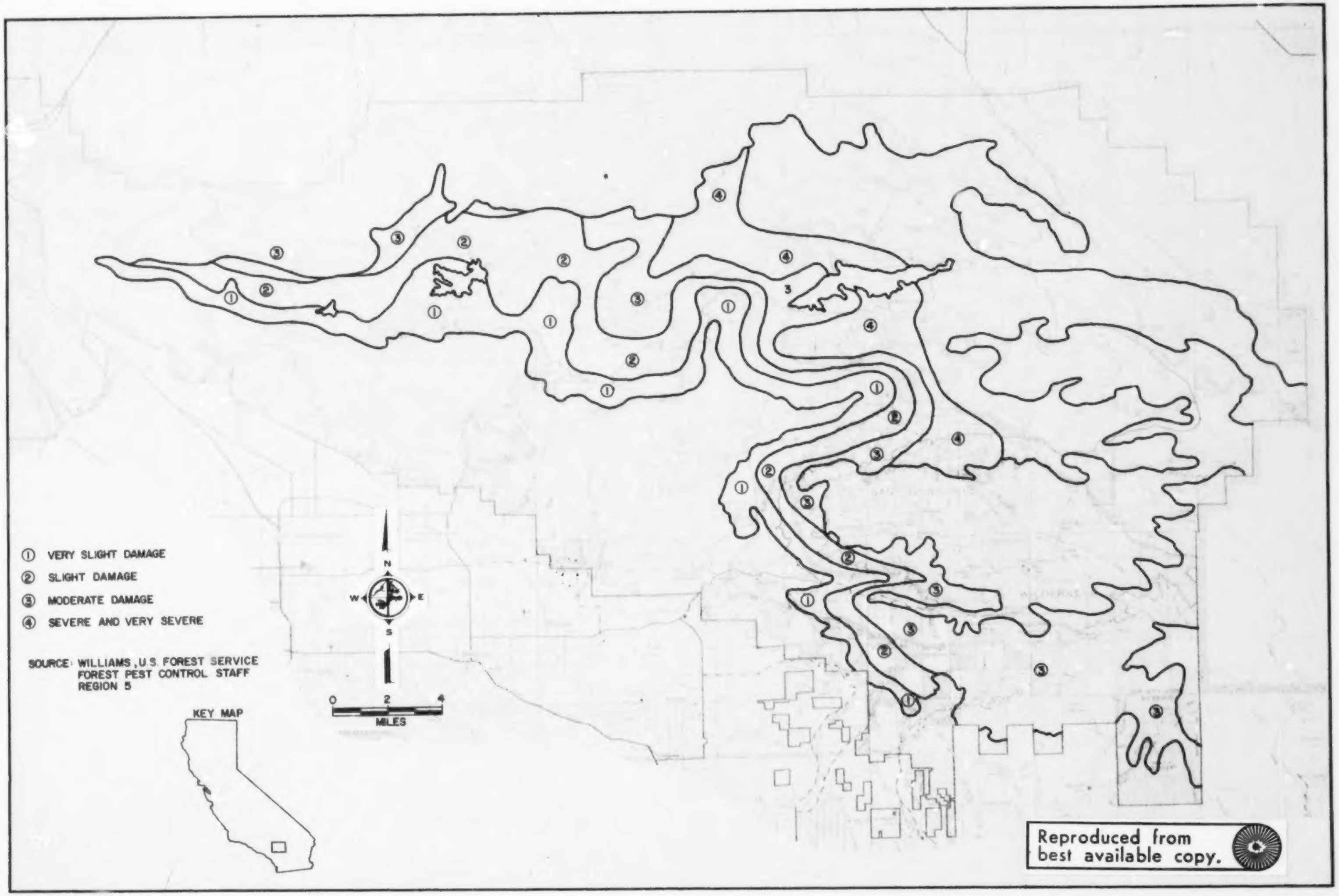
Hume Lake District of the Sequoia National Forest, Kings Canyon, and Sequoia National Park receive chronic doses of air pollutants generated in the Central Valley of California and probably from such distant sources as the San Francisco Bay Area. From this it may be concluded that air pollutants from the South Coast Air Basin could easily be transported by wind to the Cleveland and San Bernardino National Forests where vegetation can and does occur.

(3) EFFECTS ON BUILDING MATERIALS. Prolonged exposure to sulfurous smogs has caused serious damage to building marble, limestone, and mortar because the carbonates in these materials are replaced by sulfates (as $CaSO_4$ or gympsum, $CaSO_4 \cdot 2H_2O$), and these sulfates are soluble in water. Consequently, over a period of time, rain removes the altered minerals. The damage may be accompanied by discoloration from aerosols that adhere to the surface and deposit their burden of chemicals.

The potential for sulfur smogs in the Los Angeles area is great, particularly with natural gas supplies becoming unavailable. Other substitute fuels contain as much as 40 times as much sulfur as natural gas.

5. WATER SUPPLY, STORAGE, DISTRIBUTION, AND RUNOFF

Water is the transportation medium utilized to convey solid wastes to the wastewater treatment plants. The ultimate source of all water used by City residents is precipitation. The amount of rain and snow falling within the immediate area of Los Angeles City that can be effectively captured for use is less than that required by the population. Consequently, much of the water for consumption is imported from other areas—principally from sources on the eastern side of the Sierra Nevada, as well as from the Colorado River and northern California by the State Water Project. Short-term water storage is provided in reservoirs, and long-term storage in underground basins. From these, a system of treatment plants and distribution lines provides water to domestic, commercial, and industrial users. Not all of the runoff that passes through the City can be stored. An extensive stormwater and flood control program is therefore conducted by the City, the Los Angeles County Flood Control District (LACFCD), and the U.S. Army Corps of Engineers (COE). Their facilities gather storm water, capture and store as much as feasible for eventual reuse, and conduct the excess to the coast for ultimate discharge into the ocean. The adequacy of this system influences the total amount of excess water that enters the wastewater collection system as infiltration and inflow, and thus the size of treatment facilities that must be provided. Under extreme conditions, infiltration and inflow could overload the collection system, allowing stormwater-diluted untreated sewage to discharge into existing waterways, as currently occurs at Ballona Creek.


① VERY SLIGHT DAMAGE
② SLIGHT DAMAGE
③ MODERATE DAMAGE
④ SEVERE AND VERY SEVERE
N
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MILES
KEY MAP

SOURCE: WILLIAMS, U.S. FOREST SERVICE
FOREST PEST CONTROL STAFF
REGION 5

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198P-412

Figure II-47. Air pollution damage in the San Bernardino National Forest.

Wastewater treatment plants and their collection systems must be operated in such a way that they do not contaminate the water supply. This consideration applies not only to the raw and treated wastewater, but to the solids (sludge) generated in the treatment process as well. Conversely, provision of adequate sewage service minimizes the dangers to public health inherent in the extensive use of individual disposal systems, e.g., cesspools and septic tanks, which can contaminate useful sources of water, or can overflow to create direct and immediate health hazards. The inherent quality of the water in the delivery system influences the feasibility of reclaiming wastewater for ultimate reuse. The principal factor in this regard is the nature and content of dissolved minerals in the "new" water — expressed as total dissolved solids (TDS) and total hardness (TH). Wastewater always is higher in these factors than fresh water, and the minerals contributing to TDS and TH are relatively difficult and expensive to remove. Consequently, reclamation potential is governed in part by the quality of the water delivered, and there are similar limits (technical and economic) on the number of times that wastewater can be reclaimed.

a. Water Supply. Water supply for the City of Los Angeles comes mostly from snowmelt runoff in the Owens Valley. Additional sources of supply are groundwater from the San Fernando Valley and Coastal Plain Basins, and imported water delivered by the Metropolitan Water District (MWD). The MWD receives its water from the Colorado River and the State Water Project deliveries from Northern California.

In 1974-1975, the Los Angeles Aqueducts supplied the City with 80 percent, or 410.4 million gallons per day (mgd) of water, from Owens Valley and Mono Basin. An additional 14.3 percent, or 73.5 mgd, was withdrawn from San Fernando area wells and other groundwater basins for city use. Metropolitan Water District water from the Colorado River and the State Water Project made up the remaining 2.5 percent and 3.2 percent of the City's water needs, respectively. Table II-13 is an historical summary of the sources, uses, and losses from the system in fiscal years (ending June) 1966-1975.

The relative proportions of water derived from local sources, the Los Angeles Aqueduct, and the Metropolitan Water District during this period are shown in Table II-14. The Los Angeles Aqueducts provided more than half of the water supplied during the entire period, with a sharp increase in its contribution (from 60.7 to 78.3 percent) and a corresponding decrease in MWD supplies (from 25.1 to 9.0 percent) in fiscal year 1971. (This change is related to expansion of the aqueduct, as described later.) Reliance on local sources dropped from 23.5 percent in 1966 to 12.4 percent in 1972, with a subsequent modest rise. This decrease in part is attributable to litigation over rights to water in the San Fernando Valley; moderate increases occurred in withdrawals from other local sources over this period.

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Table II-13. Water supply and consumption for fiscal years ending June 30, 1966-1975 (average flow, cfs) (Department of Water and Power, 1975).

	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966
SUPPLY										
Local Wells:										
Upper Basin Los Angeles River	88.8	85.5	85.2	81.5	79.9	91.1	87.6	144.1	128.6	156.8
Central Basin	21.5	16.8	20.2	17.6	19.1	21.6	20.7	20.0	15.0	14.8
West Coast Basin	3.5	3.4	4.7	4.3	3.0	2.8	2.6	2.1	1.3	2.3
Subtotal Local Wells	113.8	105.7	110.1	103.4	102.0	115.5	110.9	166.8	144.9	173.9
Los Angeles Aqueduct	634.9	636.7	633.6	646.3	627.4	491.8	479.5	468.2	442.9	449.8
Metropolitan Water District	44.9	35.2	45.3	82.4	72.1	203.0	162.6	130.4	133.5	115.0
Gross Supply	793.6	777.6	789.0	832.1	801.5	810.3	753.0	764.8	721.3	738.7
Loss:										
Release for Groundwater Storage	8.8	0.0	0.4	0.0	2.8	2.0	5.2	4.7	6.8	6.9
To (or from) Local Surface Storage	1.8	(2.6)	(2.3)	(1.0)	(7.5)	(10.5)	(6.3)	(1.0)	(3.8)	2.4
Storage Diversions	10.6	2.6	1.9	1.0	4.7	8.5	1.1	3.7	3.0	9.3
Net Supply	783.0	780.2	790.2	833.1	806.2	818.8	754.1	761.1	718.3	729.4
DISTRIBUTION										
Producing Revenue										
Residential	361.5	361.6	365.0	397.5	384.5	387.3	360.5	365.9	348.3	358.6
Commercial	299.1	299.1	298.5	294.1	288.7	288.3	276.2	266.4	251.7	245.0
Industrial	8.7	3.6	3.7	5.3	5.6	6.8	6.9	7.3	7.8	5.2
Combined Irrigation & Residential	1.4	1.5	1.5	1.6	1.4	1.8	1.6	1.8	1.9	1.9
Intermittent Irrigation	4.2	5.0	5.6	7.1	6.9	8.0	7.6	10.3	9.3	12.7
*Power System	5.0	6.0	7.9	7.0	6.1	6.4	7.4	6.6	7.6	7.3
*Other L.A. City Departments	31.2	30.1	29.7	32.8	30.1	30.3	27.2	28.0	25.9	25.0
*Other Governmental	18.8	21.5	21.9	24.3	23.7	23.3	22.3	22.2	20.5	21.1
Other Water Utilities	0.0	0.0	0.2	1.0	1.1	-	-	-	-	-
Subtotal Producing Revenue	729.9	728.4	734.0	770.7	748.1	752.2	709.7	708.5	673.0	676.8
Nonrevenue										
Purpose of Enterprise	0.7	0.8	0.9	1.0	1.0	1.0	0.8	0.9	0.8	0.8
Net Reservoir Evaporation Loss	2.7	3.0	2.9	4.2	4.6	6.6	5.6	8.6	6.6	6.9
**Others	49.7	48.0	53.1	57.2	52.5	59.0	38.0	43.1	37.9	44.9
Subtotal Nonrevenue	53.1	51.8	56.9	62.4	58.1	66.6	44.4	52.6	45.3	52.6
TOTAL Distribution	783.0	780.2	780.9	833.1	806.2	818.8	754.1	761.1	718.3	729.4
***AVERAGE POPULATION SERVED (Millions)										
GALLONS PER CAPITA PER DAY	2.786	2.836	2.870	2.858	2.862	2.975	2.965	2.932	2.817	2.772
Net Demand	182	178	178	188	182	178	164	168	165	170
Excluding Intermittent Irrigation	181	177	177	187	180	176	163	166	163	167

NOTES:

[*] These three items total to the quantities shown as "Governmental" in statistics relating to water sales.

[**] Meter discrepancies, reservoir seepage, main leaks and other minor uses and losses.

[***] Average population served 1970-1971 through 1972-1973 adjusted to conform with 1970 census data, 1973-1974 adjusted to conform with Los Angeles County Regional Planning Commission Data, 1974-1975 based on State Department of Finance Data.

Table II-14. Percentage of water derived from local wells, Los Angeles aqueduct, and MWD for fiscal years 1966-1975 (Department of Water and Power, 1975).

FISCAL YEAR*	PERCENT DERIVED FROM		
	LOCAL WELLS	L.A. AQUEDUCT	MWD
1975	14.3%	80.0%	5.7%
1974	13.6	81.9	4.5
1973	14.0	80.3	5.7
1972	12.4	77.7	9.9
1971	12.7	78.3	9.0
1970	14.2	60.7	25.1
1969	14.7	63.7	21.6
1968	21.7	61.2	17.1
1967	20.1	61.4	18.5
1966	23.5	60.9	15.6

*Ends June 30

The demand for water is expected to increase in the future as industry and population continue to expand and grow. The future growth of water requirements will also be affected by the water conservation program of the Department of Water and Power (DWP). Expanding water needs will be even more acute because of pending curtailment of water deliveries from the Colorado River. Additional water sources that will be utilized by the Department of Water and Power include the purchase of water from the State Water Project (via MWD) and the development of water reclamation programs to reclaim wastewater for industrial use or for the recharge of groundwater basins. Past and projected sources and consumptive needs are shown in Figure II-48 (DWP, May 1976). Decreasing per capita consumption is expected to be offset by increasing population. Note that this projection anticipates use of reclaimed water, beginning in the mid-1980s.

(1) THE LOS ANGELES AQUEDUCTS. To meet the City's increasing demand for water, the Los Angeles DWP constructed the Los Angeles Aqueduct to import water from the Owens Valley, and subsequently from the Mono Basin. The initial 233-mile aqueduct, completed in 1913, was extended into the Mono Basin in 1940, increasing the total length of the Los Angeles Aqueduct

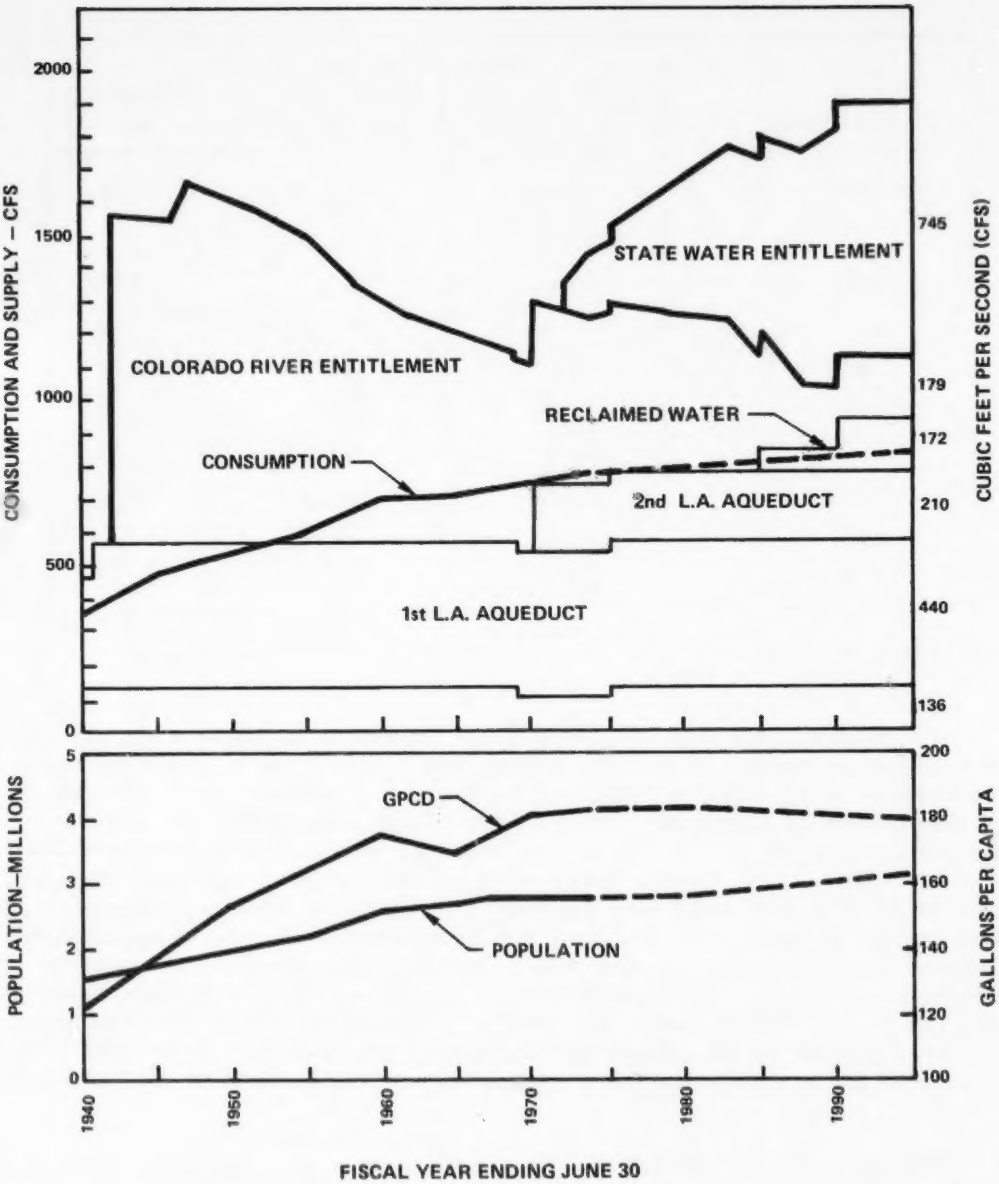

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Figure II-48. Past and projected sources and consumption of water by Department of Water and Power (DWP, May 1976).

system to 338 miles. In 1963, the DWP adopted plans for a second aqueduct to obtain additional water supplies from the High Sierra. Plans to construct the second aqueduct were brought about by the uncertain future of the Colorado River as a source of supply, the economic advantage of further development of the Owens River-Mono Basin facilities, and the superior quality of water from this area. In August 1964, initial construction began, and the second aqueduct, which roughly parallels the first, was completed in 1970, increasing the delivery capacity from 440 cubic feet per second (cfs) to 650 cfs.

Generally, water delivered from the Owens and Mono drainage basins is of excellent quality and is sodium-calcium bicarbonate in character. For approximately 30 years prior to 1969, the total dissolved solids (TDS) averaged 214 milligrams per liter (mg/l) with a high recording of 322 mg/l (1946) and a low of 149 mg/l (1941). In 1974, the TDS concentration was approximately 171 mg/l with a corresponding total hardness (TH) of 78 mg/l. The quality of water from the Owens-Mono Basin is expected to remain relatively constant in the foreseeable future.

(2) THE COLORADO RIVER AQUEDUCT. In 1927, the California State Legislature authorized the formation of the Metropolitan Water District of Southern California (MWD), initially comprised of Los Angeles and twelve other cities, to construct and operate an aqueduct to import Colorado River water. In 1931, the thirteen cities of the MWD approved a $220 million bond issue to finance construction of the aqueduct. In 1941, after approximately eight years of construction, the 300-mile Colorado River Aqueduct system was placed in operation. The MWD presently consists of the original thirteen cities and twelve municipal water districts with a county water authority, and serves approximately 120 cities and many unincorporated areas in six Southern California counties. The total delivery to the Southern California Coastal Plain is approximately one billion gallons per day.

The City of Los Angeles receives approximately 42 million gallons per day of Colorado River water which represents only eleven percent of the City's preferential water right, leaving a substantial reserve entitlement. However, it has become apparent that the average flow of the river is insufficient to meet future demands of planned water projects of states in the Colorado River Basin. The U.S. Supreme Court case of *Arizona v. California, et al* in 1964 resulted in the long range reduction of MWD's right to Colorado River water from the original entitlement of 1.2 million to 550,000 acre-feet per year.

Colorado River water is sodium-calcium sulfate in character. Treatment to reduce hardness yields water of sodium sulfate character. A TDS high of 875 mg/l occurred in 1955 and a low of 625 mg/l occurred in 1959 with the average for the last 32 years being 743 mg/l. In 1974, the TDS averaged approximately 700 mg/l at the Whitsett Intake Pumping Plant. In the future it is expected that Colorado River water will be significantly poorer in quality, with TDS values of over 1000 mg/l probable at Parker Dam, the diversion point for the City's Colorado River Supply.

(3) STATE WATER PROJECT. In 1951, the California Legislature authorized the State Department of Water Resources (DWR) to construct the Feather River Project, later called the State Water Project (SWP). The purpose of the project was to convey surplus water supplies in the northern portion of the state to areas of deficiency in Central and Southern California. The project was also designed to provide flood control capabilities, power generation, recreation, salinity control in the Sacramento River Delta, and enhancement of fish and wildlife habitat.

Construction of the approximately $2.8 billion SWP was begun in 1957 and is presently nearing completion. The MWD has contracted with the DWR for over two million acre-feet per year of Project water. The City of Los Angeles, being a member of the MWD, will share this water supply source as needed. In response to the growing need for more water conservation, reclamation studies are underway to update the California Water Plan.

State Water Project water is sodium calcium bicarbonate-chloride-sulfate in character and generally has less TDS and TH than both local and Colorado River supplies. During 1973-74, the TDS averaged 322 mg/l and hardness averaged 160 mg/l showing a slight improvement over the previous year.

(4) LOCAL WATER SUPPLIES. Local water supplies are derived principally from wells that pump water stored in underground basins. The major source of such water is the upper basin of the Los Angeles River (the general area of the San Fernando Valley), which accounted for 78 percent of all the locally supplied water in fiscal year 1975. Lesser amounts were obtained from the Central Basin which underlies the entire city east of the Baldwin Hills except for the San Fernando Valley, Harbor, and "shoestring strip" areas, and the West Coast Basin (adjacent to Santa Monica Bay), which contributed 18.9 and 3.1 percent of the total, respectively.

Although much of this water is derived from local precipitation, some in the Upper Basin represents imported water stored underground for subsequent withdrawal, and some in the Central Basin is also derived from artificial replenishment by agencies other than DWP. The amount of local water available for storage depends on the intensity and duration of storms in the drainage area tributary to the various underground basins.

The quality of groundwater is greatly dependent on the composition of surface runoff and the material through which the water percolates. Surface water within the Los Angeles area picks up salts dissolved from rocks during runoff and is generally calcium bicarbonate in character. In 1973-74, TDS concentrations averaging 805 mg/l and a total hardness of 335 mg/l were found just above the Los Angeles Narrows.

The quality of water derived from the Upper Basin, also known as the Upper Los Angeles River Area (ULARA), varies greatly. Water quality (as measured by TDS) is generally highest in the northern part of the basin, but deteriorates as it moves southwestward toward the Los Angeles Narrows. Water quality is poorest in the westernmost part of the ULARA, where deposits of gypsum, a mineral formed from calcium sulfate, are present in geological strata known as the Modelo formation. This mineral dissolves in the groundwater, giving TDS levels in the range of 1000 to 3000 mg/l. In general, water extracted from the eastern wells has TDS values below 800 mg/l (Department of Water and Power, April 1976).

Some wells located in the western end of the Valley, and in the Verdugo Basin above Glendale have unusually high concentrations of nitrate, possibly as the result of lingering effects of cesspool and septic tank effluents.

Quality of water in the Central Basin is good. A well operated by the City of Vernon showed a general range in TDS from 466 to 375 mg/l from 1952 to 1971, and a well operated over the same period by the City of Lynwood showed a TDS range from 425 to 294 mg/l (SWRCB, March 1975).

In the Coastal Plain Hydrographic Unit, TDS concentrations generally range from 200 mg/l to approximately 400 mg/l.

b. Distribution and Surface Storage. Figure II-49 shows the major water distribution lines within the service area. Imported water is received from the north via the Los Angeles Aqueduct, and from the east via the Colorado River Aqueduct of the MWD. The MWD supplies both Colorado River and State Water Project water to the system. State Water Project water at Castaic Reservoir is not presently connected to the MWD system, but hydroelectric power is supplied to the City by an upstream generating plant as shown.

The major evolution of this system began in 1913, when water was first delivered to the City from the Los Angeles Owens River Aqueduct. By 1915 this water was available for irrigation in the San Fernando Valley. Upon completion of several reservoirs, service was extended throughout the City of Los Angeles. Completion of the Chatsworth High Line in 1916 and the Maclay High Line in 1917 provided service for additional areas in the San Fernando Valley.

The Lower Van Norman Reservoir, formerly part of the Los Angeles Aqueduct system, was severely damaged and rendered inactive by the February 9, 1971, Sylmar Earthquake. The Los Angeles Reservoir will replace the Van Norman Reservoir and will become the new terminus for the Los Angeles Aqueduct.

These reservoirs supply various distribution reservoirs located in the mountains and hills above the San Fernando Valley and the Coastal Plain. Some of the major distribution reservoirs within the metropolitan area of Los Angeles include: Stone Canyon (10,370 ac-ft), Encino (10,300 ac-ft), Chatsworth (9,886 ac-ft), Lower Hollywood (4,029 ac-ft) and Silver Lake (2,020 ac-ft).

Table II-15 summarizes the surface storage facilities of the City of Los Angeles DWP Water system. The drop in capacity in 1971 associated with the destruction of the Van Norman Reservoir is apparent from the table. Total capacities of the other surface storage systems have remained relatively constant since that time. Surface storage systems allow for

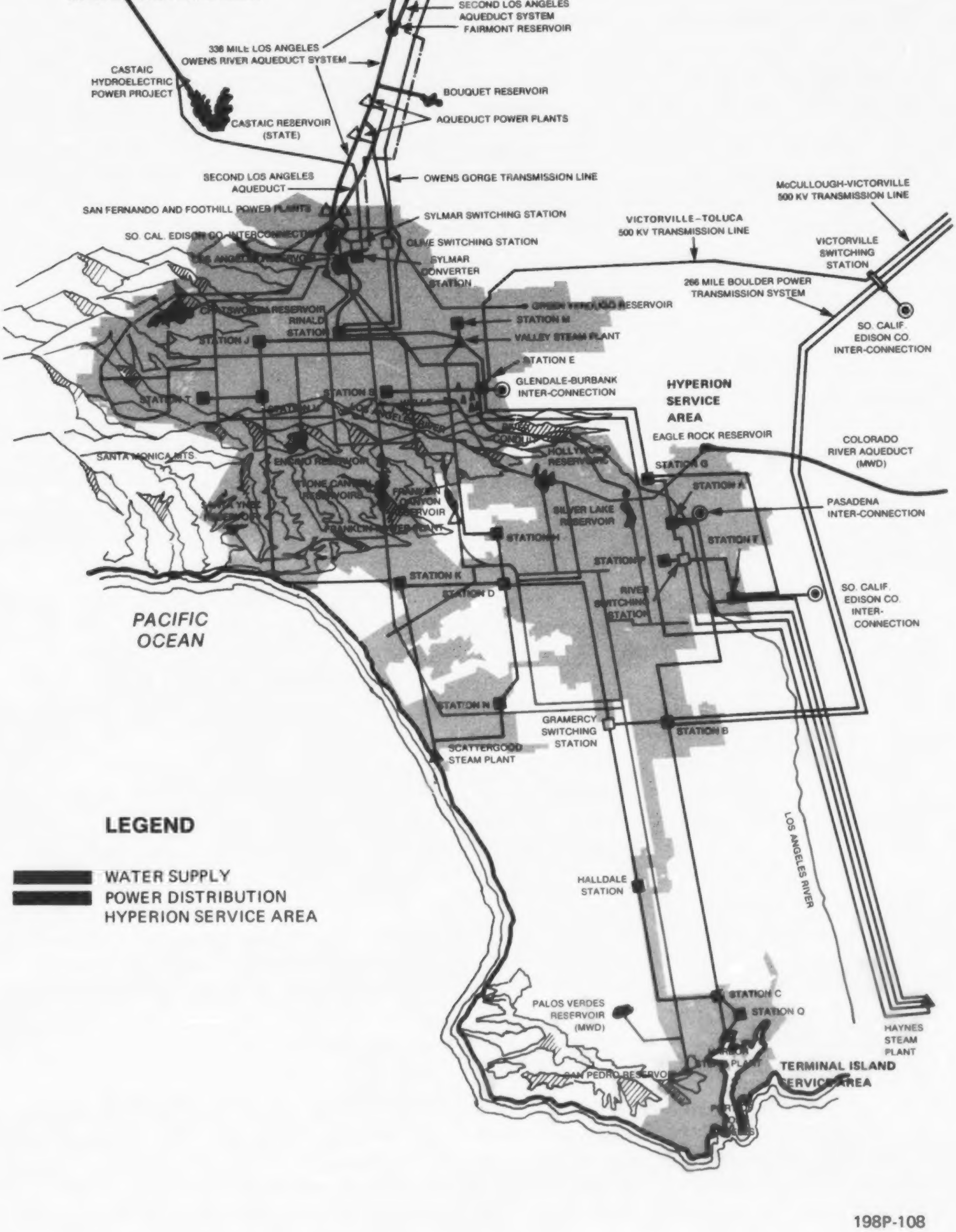
CALIFORNIA AQUEDUCT (WEST BRANCH)
PACIFIC INTERTIE D.C.
SECOND LOS ANGELES AQUEDUCT SYSTEM
FAIRMONT RESERVOIR
338 MILE LOS ANGELES OWENS RIVER AQUEDUCT SYSTEM
CASTAIC HYDROELECTRIC POWER PROJECT
BOUQUET RESERVOIR
AQUEDUCT POWER PLANTS
CASTAIC RESERVOIR (STATE)
SECOND LOS ANGELES AQUEDUCT
OWENS GORGE TRANSMISSION LINE
SAN FERNANDO AND FOOTHILL POWER PLANTS
SYLMAR SWITCHING STATION
SO. CAL. EDISON CO. INTERCONNECTION
OLIVE SWITCHING STATION
LOS ANGELES RESERVOIR
SYLMAR CONVERTER STATION
MᴄCULLOUGH-VICTORVILLE 500 KV TRANSMISSION LINE
VICTORVILLE–TOLUCA 500 KV TRANSMISSION LINE
VICTORVILLE SWITCHING STATION
266 MILE BOULDER POWER TRANSMISSION SYSTEM
GREEN VERDUGO RESERVOIR
CHATSWORTH RESERVOIR
STATION M
RINALDI STATION
STATION J
VALLEY STEAM PLANT
SO. CALIF. EDISON CO. INTER-CONNECTION
STATION E
GLENDALE-BURBANK INTER-CONNECTION
STATION T
STATION V
STATION S
LOS ANGELES RIVER
HYPERION SERVICE AREA
RIVER CONDUIT
EAGLE ROCK RESERVOIR
SANTA MONICA MTS.
ENCINO RESERVOIR
HOLLYWOOD RESERVOIRS
COLORADO RIVER AQUEDUCT (MWD)
STATION G
STONE CANYON RESERVOIRS
FRANKLIN CANYON RESERVOIR
STATION A
SANTA YNEZ RESERVOIR
SILVER LAKE RESERVOIR
PASADENA INTER-CONNECTION
FRANKLIN RIVER PLANT
STATION H
STATION F
STATION P
STATION K
STATION D
RIVER SWITCHING STATION
SO. CALIF. EDISON CO. INTER-CONNECTION
PACIFIC OCEAN
STATION N
GRAMERCY SWITCHING STATION
STATION B
SCATTERGOOD STEAM PLANT
LOS ANGELES RIVER
LEGEND
WATER SUPPLY
POWER DISTRIBUTION
HYPERION SERVICE AREA
HALLDALE STATION
STATION C
PALOS VERDES RESERVOIR (MWD)
STATION Q
HAYNES STEAM PLANT
HARBOR STEAM PLANT
TERMINAL ISLAND SERVICE AREA
SAN PEDRO RESERVOIR
PORT OF LOS ANGELES
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Figure II-49. Principal water and power distribution lines in Los Angeles Area.

Table II-15. Summary of reservoir and tank storage capacities, fiscal years 1966-1975 (Department of Water and Power, 1975).

	NUMBER AND CAPACITY IN ACRE-FEET ON JUNE 30																			
	1975		1974		1973		1972		1971		1970		1969		1968		1967		1966	
	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY	NO.	CAPACITY
AQUEDUCT AREA																				
Impounding Reservoirs	6	340,245	6	340,425	5	342,425	5	342,425	5	342,425	5	342,425	5	342,425	5	342,425	5	342,425	5	342,425
Flow Regulating Reservoirs	2	11,599	2	11,599	2	9,188	2	9,188	2	11,392	2	11,392	2	11,392	2	11,392	2	11,392	2	12,143
Subtotal	8	351,844	8	351,844	7	351,613	7	351,613	7	353,817	7	353,817	7	353,817	7	353,817	7	353,817	7	354,568
CITY AREA																				
San Fernando Valley Districts																				
Major Storage Facility	11	12,120	11	12,121	11	11,251	10	21,031	10	21,901	9	42,170	9	42,170	9	42,170	9	42,170	9	42,170
Minor Storage Facility	23	58	23	58	23	58	23	58	23	57	23	57	23	57	24	59	24	59	23	56
Subtotal	34	12,178	34	12,179	34	11,309	33	21,089	33	21,958	32	42,227	32	42,227	33	42,229	33	42,229	32	42,226
Central and Western Districts																				
Major Storage Facility	17	17,660	17	17,660	18	19,282	18	19,282	18	19,728	17	19,321	17	19,321	17	19,321	17	19,321	17	19,321
Minor Storage Facility	38	91	39	88	39	88	39	88	38	88	37	83	37	83	37	83	38	83	37	77
Subtotal	55	17,751	56	17,748	57	19,370	57	19,370	56	19,816	54	19,404	54	19,404	54	19,404	55	19,404	54	19,398
Harbor District																				
Major Storage Facility	1	26	1	26	1	26	1	26	1	26	1	26	1	26	1	26	1	26	1	26
Minor Storage Facility	6	21	6	21	6	21	6	21	6	21	6	21	6	21	5	18	5	18	5	18
Subtotal	7	47	7	47	7	47	7	47	7	47	7	47	7	47	6	44	6	44	6	44
Subtotal City Area	96	29,976	97	29,947	98	30,726	97	40,506	96	41,821	93	61,678	93	61,678	93	61,677	94	61,677	92	61,668
SUMMARY																				
Aqueduct Reservoirs	8	351,844	8	351,844	7	351,613	7	351,613	7	353,817	7	353,817	7	353,817	7	353,817	7	353,817	8	354,568
Major City Storage Facilities	29	29,806	29	29,807	30	30,559	29	40,339	29	41,655	27	61,517	27	61,517	27	61,517	27	61,517	27	61,516
Minor City Storage Facilities	67	170	68	167	68	167	68	167	67	166	66	161	66	161	66	160	67	160	65	151
TOTAL ENTIRE SYSTEM	104	381,820	105	381,818	105	382,339	104	392,119	103	395,638	100	415,495	100	415,495	100	415,594	101	415,494	100	416,236

NOTE: Major resources over 2.5 million gallons. Minor storage facilities (primarily tanks). See C-1148-1-4 "Reservoir and Tank Data."

relatively short-term variations in demand, and tend to improve water quality through settling of suspended solids and dissipation of chlorine residuals.

Consumption data for the fiscal years 1966 through 1975 were shown in Table II-13 for various consumer categories. "Intermittent irrigation" decreased by a factor of three over the 10-year period, reflecting the decreasing importance of agriculture in the area served by DWP. Table II-16 summarizes the percentages distributed to each major category of users during the same period. In relative percentages, there has been a decrease in residential consumption over this period, accompanied by an irregular overall increase in commercial uses. The percentage consumed by industrial users dropped fairly uniformly from fiscal year 1967 to fiscal year 1974, but then more than doubled.

"Intermittent irrigation" decreased by a factor of three over the 10-year period, reflecting the decreasing importance of agriculture in the area served by DWP.

c. Subsurface Storage (Groundwater).

(1) BACKGROUND. Large volumes of water can be stored in naturally occurring subsurface basins, and recovered by wells. These basins are

Table II-16. DWP water deliveries to residential, commercial and industrial consumers (percent of total), fiscal years 1966-1975 (Department of Water and Power, 1975).

FISCAL YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	AVERAGE DELIVERY RATE
1975	54.0%	44.7%	1.3%	669.3
1974	54.4	45.0	0.6	664.3
1973	54.7	44.7	0.6	667.2
1972	57.0	42.2	0.8	696.9
1971	56.7	42.5	0.8	678.8
1970	56.8	42.2	1.0	682.4
1969	56.0	42.9	1.1	643.6
1968	57.2	41.7	1.1	639.6
1967	57.3	41.4	1.3	607.8
1966	58.9	40.2	0.9	608.8
Average	56.3	42.8	0.9	

supplied with water by local precipitation, or can be recharged artificially with imported or reclaimed water. In its simplest form, a groundwater basin can be compared to a tub filled with loose gravel. Water poured into the tub filters through the gravel, and forms a pool at the bottom, confined by the tub walls. The surface of this pool of water is the "water table."

For a sufficient amount of water to be stored, the gravel must have a significant amount of open space around the rock particles — that is, it must be porous. If water is to be withdrawn, it must also be able to move freely from various regions in the tub to the pumping point. The gravel must therefore have a reasonable degree of permeability — that is, water must be able to move more or less freely through the gravel to the pumping point.

In nature, the "tub" of the simple example given above is replaced by naturally impermeable rock formations, and the gravel by overlying rock formations with reasonable permeability, often layered, and composed of such materials as sand, silt, and gravel. Adequate porosity and permeability may be obtained even in hard, impermeable rocks such as granites if they are sufficiently fractured and broken, while, on the other hand, very fine-grained materials, such as soils, may be unsuitable because water cannot move through them readily, and even if the attempt is made, much of the water remains attached to the soil particles.

Moreover, the basin in which the water is contained need not necessarily be confined. Although water underground is essentially in constant motion (though perhaps extremely slowly), a useful groundwater basin may actually eventually discharge into the ocean, but saline intrusion is not a problem as the flow of water into the ocean from groundwater restrains the motion of saline water inland.

The layers of rock in which water is stored may consist of both permeable and impermeable (or poorly permeable) strata. (The permeable layers are known as aquifers, the impermeable layers as aquicludes.) The water-bearing layers may thus be confined, and can be under pressure. In this case there is no "water table" as the term was simply defined above. If a well is drilled into the pressurized water-bearing zone, the water will rise in response to the pressure, to a level known as the piezometric surface. Areas where such conditions exist are often known as "pressure zones." The entire sequence of layers is known as a geohydrologic unit.

The limits of the individual basin that carries the water-bearing strata may be established by the topography of the basin in which the water-bearing strata were deposited, or by tilting or actual rupture of the rocks by geologic processes that occurred after their deposition (folding and faulting). Artificial subterranean dams may also be constructed to increase the capacity of groundwater storage basins.

Groundwater near the surface may also be associated with layers of impermeable rock of limited areal extent. The associated groundwater surface is known as a "perched" water table (often filling during rainy periods, and subsequently draining), as shown in Figure II-49. Such perched water tables may not be important as water storage facilities, but are mentioned here because they may contribute to wet-weather infiltration into sewer lines.

It is possible to draw water from any single aquifer of a geohydrologic unit if the well is lined where it crosses other aquifers. Unlined wells draw from the entire unit. Well pumping causes localized lowering of the water table (or the piezometric surface), as shown in Figure II-50. If a large number of wells are pumping in a fairly restricted area, a large net drawdown curve can be created, often called a pumping hole.

When the water withdrawn exceeds the water replenished, the water table can be lowered over a wide area. A "safe yield" is associated with each basin, determined by the annual amount of pumping that will not cause adverse effects to occur, such as decreased basin capacity (sometimes associated with ground subsidence), degradation of water quality, or infringement upon the legal rights of others.

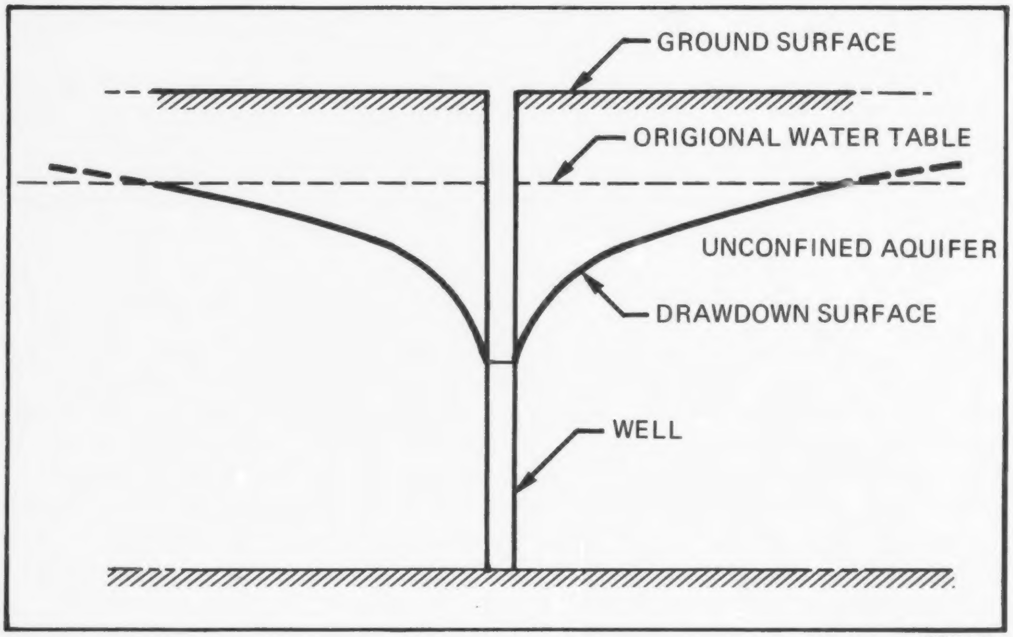


Figure II-50. Simplified cross section through hydrogeologic unit.

Overpumping of basins near the coast may also reverse the natural flow, so that seawater starts to flow inland, contaminating nearshore wells. This situation is often overcome by pumping fresh water *into* lines of wells along the coast, creating a series of peaks rather than drawdown curves, with the injected water moving away from rather than toward the well. As a result, a barrier is created against seawater intrusion into the aquifer, even though the general level of water in the aquifer (water table or piezometric surface) is below sea level.

When groundwater basins are intensively used and different agencies and individuals have legal rights to the waters, they are often operated under the supervision and regulation of a Watermaster. The Watermaster operates under the authority of various court decisions, and is responsible for recording and reporting groundwater withdrawal activities to the Superior Court rendering the decisions.

Essentially all of the elements described briefly above are present in the Los Angeles area, where subsurface waters provide a substantial resource, both for local consumption and for storage of imported waters. Future use of these subsurface storage units in conjunction with the reclamation of suitably treated wastewater is also a real possibility. Some reclaimed water is already being infiltrated into groundwater by plants of the County Sanitation Districts, and some will also be recovered in conjunction with discharges of tertiary-treated water from the Los Angeles-Glendale Water Reclamation plant into the Los Angeles River.

(2) GROUNDWATER BASINS. The groundwater basins as defined in the Basin Plan for the Los Angeles River Basin (4B) are shown in Figure II-51 (SWRCB, 1975). The more important basins with respect to the Facilities Plan are the San Fernando Hydrographic Subunit (shown to the left of the upper center of the figure), the Central Basin (in the central and lower right areas of the figure), and the West Coast Basin (at the lower left of the figure, adjacent to Santa Monica Bay).

With relation to the introductory discussion, note that the San Fernando Hydrographic Subunit lies in an essentially closed basin, though if "full" it could spill into the lower basins through the Los Angeles Narrows. The Central Basin has both unconfined water in its northern sections, and a pressure area to the south. The West Coast Basin is immediately adjacent to the sea, and subject to seawater intrusion; a seawater barrier (well-injection) system is thus maintained to prevent deterioration of groundwater quality in this area.

Lines of equal elevation of groundwater and generalized movement of groundwater in the area as they existed in the fall of 1971 are shown in Figure II-52 (SWRCB, 1975). Each line shown represents the level above mean sea level at which the surface of the water table would be found: for example, at all points on a line marked "750," the surface of the water table or piezometric surface would have been encountered at 750 feet above mean sea level at that date. The actual depth to water would vary, however, along this line depending on the elevation of the surface immediately above it. The groundwater tends to move from points of higher water elevation to lower ones, in response to the pressure differences associated with different water levels.

In this regard, two broad generalizations are of note: (1) in the San Fernando Valley region, water tends to move generally easterly and somewhat southerly toward a pumping "hole" in the eastern part of the Valley, where extensive well fields are maintained, and (2) most of the water in the Coastal Basin is seen to flow generally southwestward, from the Whittier Narrows. The effect of the seawater barrier along the southern part of Santa Monica Bay is also apparent; much of the water in the adjacent basin is below sea level, but injection has raised levels along the coast to above sea level (though not above the ground surface) to prevent seawater intrusion.

Contours on this map are not fully indicative of today's conditions, particularly in the vicinity northwest of Long Beach where the "Dominguez Gap" seawater barrier facility presently exists, but was not fully operational until after 1971. It is, however, indicative of general trends.

Discontinuities in the lines of equal groundwater elevation can be observed at various places throughout the area. These are associated predominantly with geologic faulting, although folding also modifies the pattern, and one subterranean dam has been constructed to increase basin capacity.

Groundwater is chiefly found in relatively young (Quaternary) sedimentary deposits, although some is derived from older (Tertiary) sedimentary rocks. The areal extents of these materials at the surface are shown in blue and green, respectively, on the geologic map of Figure II-9. Groundwater is also present in fractured volcanic rocks, as shown in Figure II-51, but such deposits are not an important source for useful quantities of water. Details on the characteristics of the various groundwater basins are given in the Water Quality Control Plan Report for the Los Angeles River Basin (4B) (SWRCB, 1975), to which the interested reader is referred. With respect to the Facilities Plan, the Upper Los Angeles River Area (San Fernando Valley) is of greatest importance.

(3) UPPER LOS ANGELES RIVER AREA. Of the groundwater basins shown on Figure II-51, the Upper Los Angeles River Area (ULARA) and the San Fernando Basin in particular are the most important with respect to environmental evaluation of the Facilities Plan. This area is currently the major source for withdrawals of local water, and is the only area in which imported water is stored underground by the City for subsequent use. Moreover, most of the alternatives in the Facilities Plan contemplate

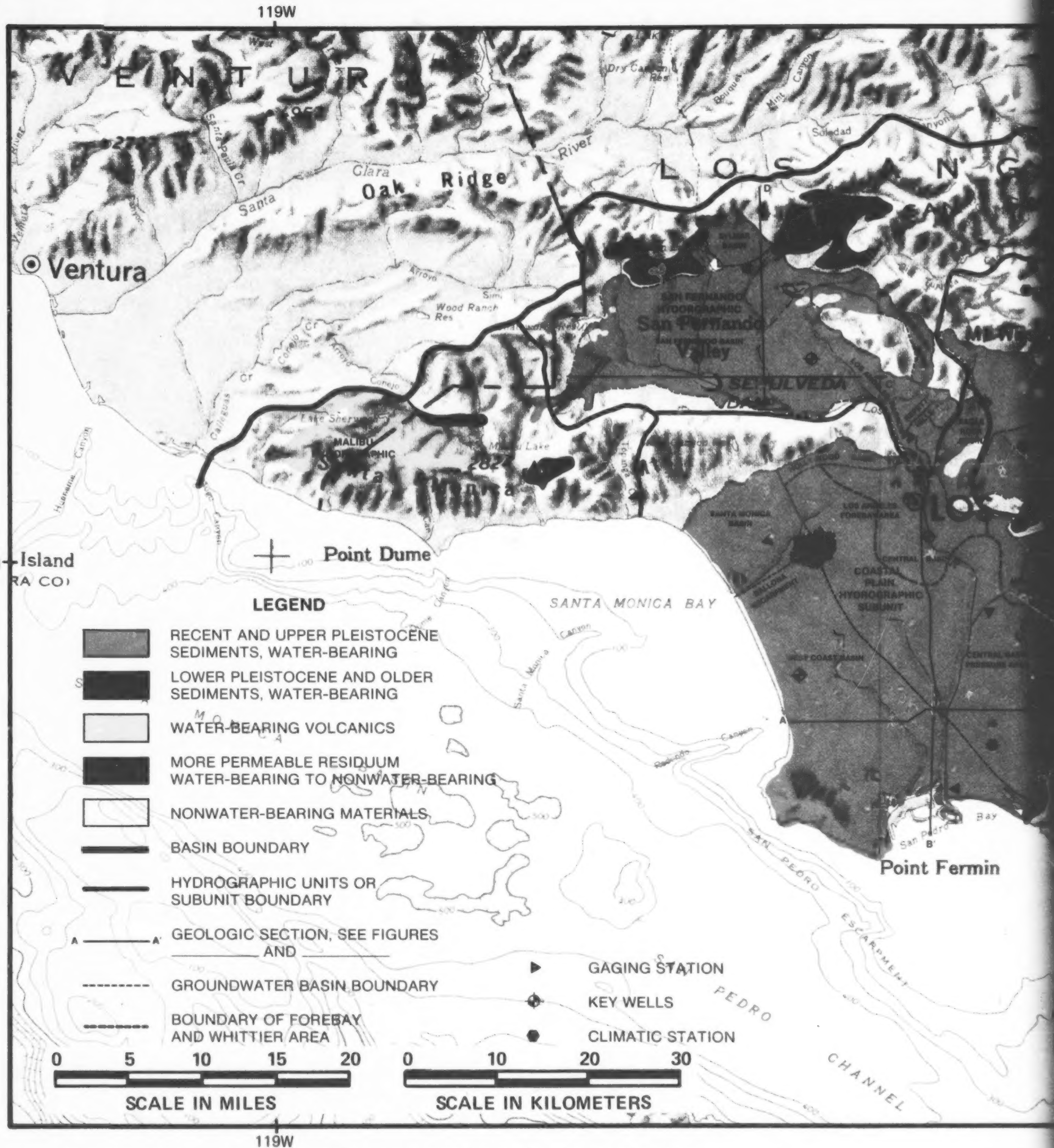
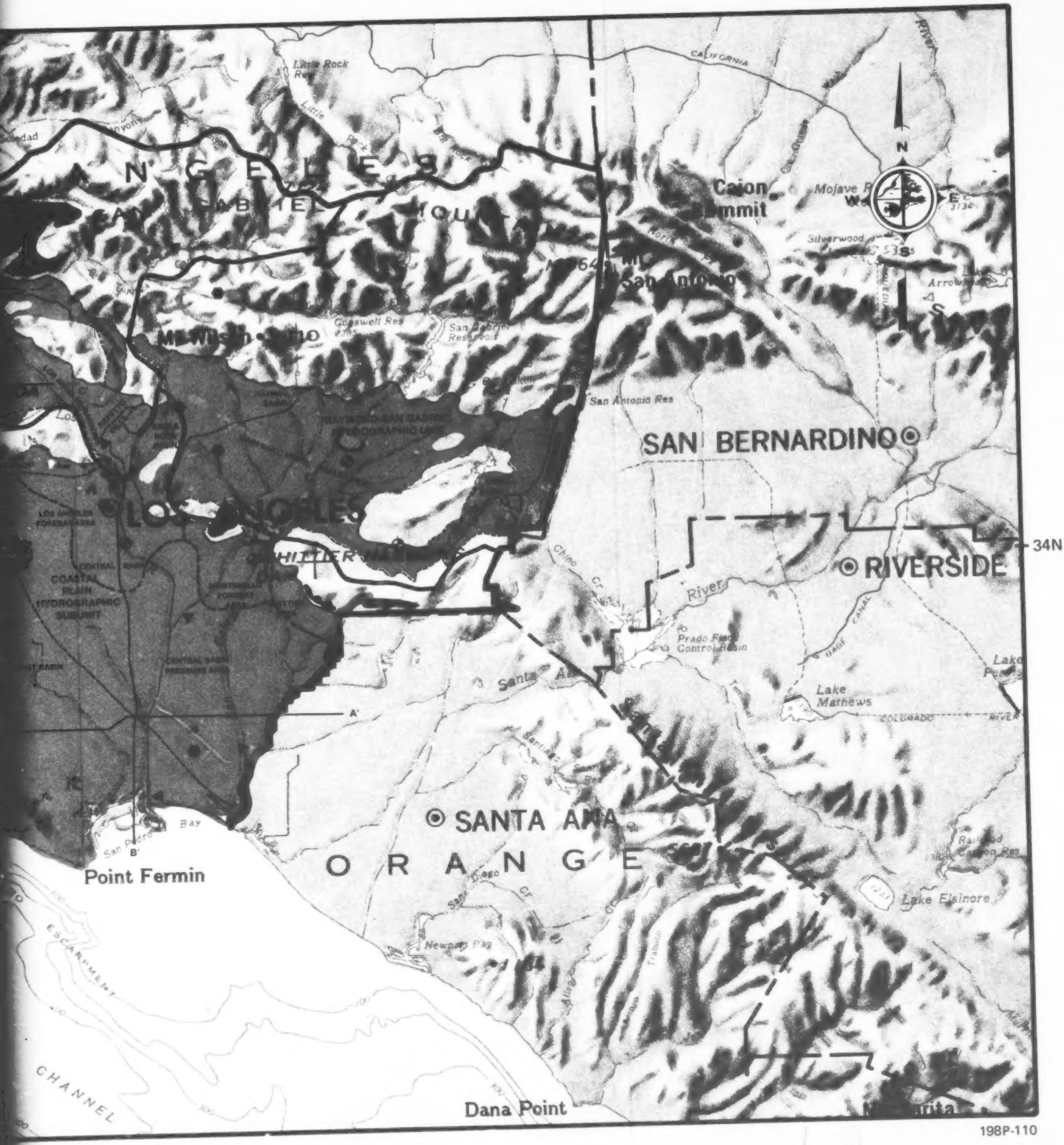
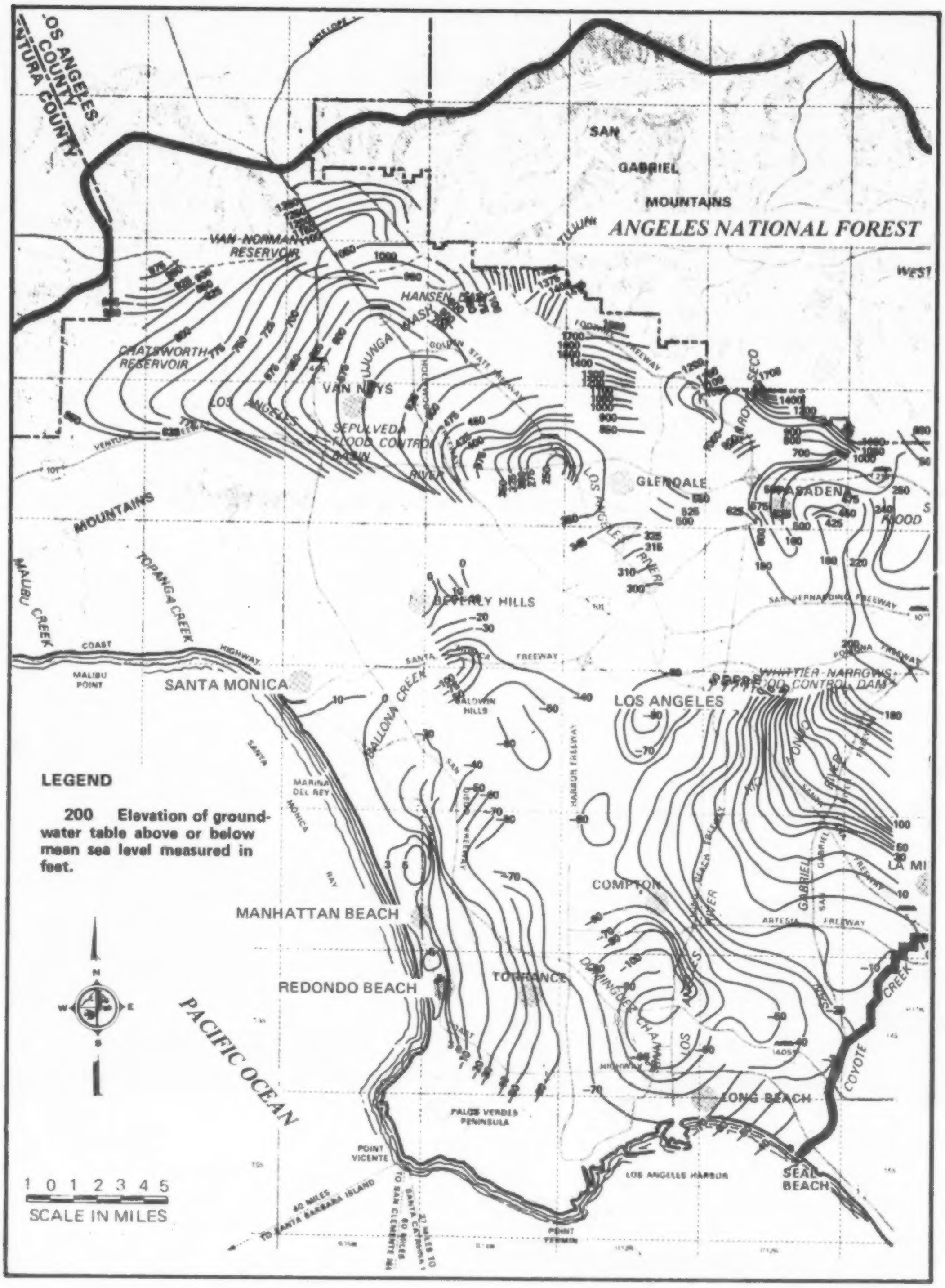

119W
VENTURA
LOS ANGELES
Oak Ridge
Santa Clara River
Ventura
Wood Ranch Res
Simi
Arroyo
Dry Canyon Res
Soledad
San Fernando Hydrographic
San Fernando Valley
SEPULVEDA DAM
Malibu Hydrographic
Santa Monica
Point Dume
34N
Island
SANTA MONICA BAY
Santa Monica Basin
Los Angeles Forebay Area
Central Basin
Coastal Plain Hydrographic Subunit
West Coast Basin
Point Fermin
San Pedro Bay
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
LEGEND
RECENT AND UPPER PLEISTOCENE SEDIMENTS, WATER-BEARING
LOWER PLEISTOCENE AND OLDER SEDIMENTS, WATER-BEARING
WATER-BEARING VOLCANICS
MORE PERMEABLE RESIDUUM WATER-BEARING TO NONWATER-BEARING
NONWATER-BEARING MATERIALS
BASIN BOUNDARY
HYDROGRAPHIC UNITS OR SUBUNIT BOUNDARY
A A' GEOLOGIC SECTION, SEE FIGURES ______ AND ______
GROUNDWATER BASIN BOUNDARY
BOUNDARY OF FOREBAY AND WHITTIER AREA
GAGING STATION
KEY WELLS
CLIMATIC STATION
0 5 10 15 20
SCALE IN MILES
0 10 20 30
SCALE IN KILOMETERS
119W

Figure II-51. Groundwater Basins as defined in the Basin Plan for the Los Angeles River Basin (SWRCB, 1975).


Little Rock Res
Little Rock
CALIFORNIA
A N G E L E S
SAN GABRIEL MOUNTAINS
Cajon Summit
Mojave R
Silverwood
N
W
E
S
Mt Wilson
Cogswell Res
San Gabriel Reservoir
San Antonio
Arrowhead
San Antonio Res
RAYMOND-SAN GABRIEL HYDROGRAPHIC UNIT
SAN BERNARDINO
LOS ANGELES
LOS ANGELES FOREBAY AREA
WHITTIER NARROWS
CENTRAL BASIN
COASTAL PLAIN HYDROGRAPHIC SUBUNIT
MONTEBELLO FOREBAY AREA
CENTRAL BASIN PRESSURE AREA
WEST BASIN
34N
RIVERSIDE
Chino Cr
River
Prado Flood Control Basin
Santa Ana
Lake Mathews
COLORADO RIVER
Lake Perris
A'
SANTA ANA
ORANGE
San Pedro Bay
B'
Point Fermin
Railroad Canyon Res
Lake Elsinore
San Diego Cr
Newport Bay
ESCARPMENT
CHANNEL
Dana Point
Margarita

198P-110


LOS ANGELES COUNTY
VENTURA COUNTY
SAN GABRIEL MOUNTAINS
ANGELES NATIONAL FOREST
VAN NORMAN RESERVOIR
CHATSWORTH RESERVOIR
HANSEN DAM
TUJUNGA WASH
VAN NUYS
SEPULVEDA FLOOD CONTROL BASIN
LOS ANGELES RIVER
GLENDALE
ARROYO SECO
PASADENA
MOUNTAINS
MALIBU CREEK
TOPANGA CREEK
MALIBU POINT
COAST HIGHWAY
SANTA MONICA
BEVERLY HILLS
SANTA MONICA FREEWAY
SAN BERNARDINO FREEWAY
WHITTIER NARROWS FLOOD CONTROL DAM
LOS ANGELES
BALLONA CREEK
BALDWIN HILLS
MARINA DEL REY
SANTA MONICA BAY
SAN DIEGO FREEWAY
HARBOR FREEWAY
COMPTON
MANHATTAN BEACH
REDONDO BEACH
TORRANCE
DOMINGUEZ CHANNEL
SAN GABRIEL RIVER
ARTESIA FREEWAY
COYOTE CREEK
LONG BEACH
PACIFIC OCEAN
PALOS VERDES PENINSULA
POINT VICENTE
LOS ANGELES HARBOR
POINT FERMIN
SEAL BEACH
LA MIRADA
40 MILES TO SANTA BARBARA ISLAND
60 MILES TO SAN CLEMENTE ISLAND
22 MILES TO SANTA CATALINA
LEGEND
200 Elevation of ground-water table above or below mean sea level measured in feet.
N
S
E
W
1 0 1 2 3 4 5
SCALE IN MILES

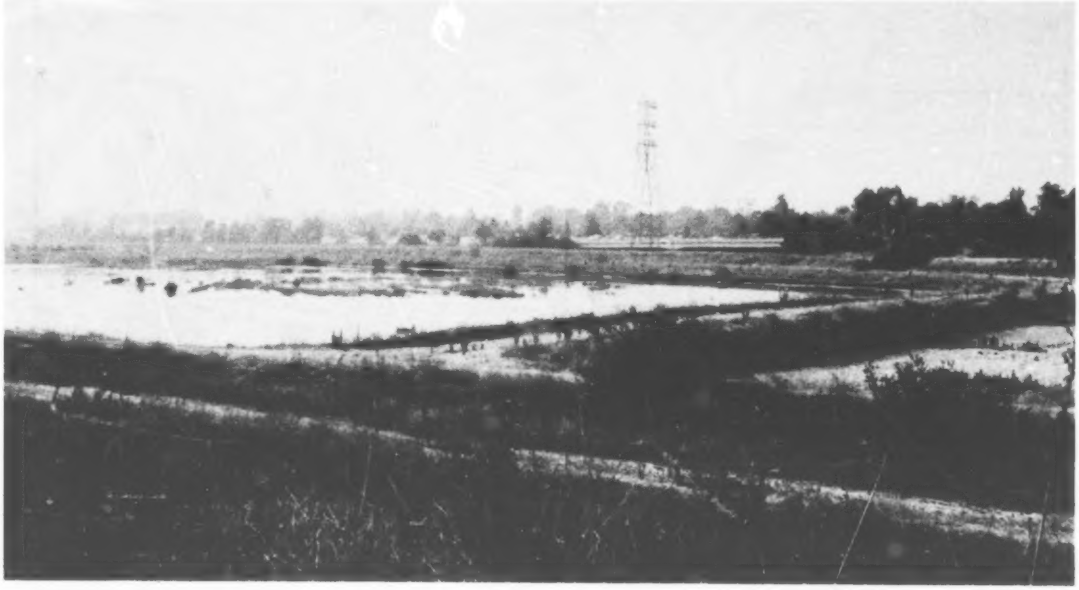
198P-111

Figure II-52. Lines of equal elevation of groundwater, Fall 1971, (SWRCB, 1975).

construction of plants in the San Fernando Valley that would provide tertiary levels of treatment.

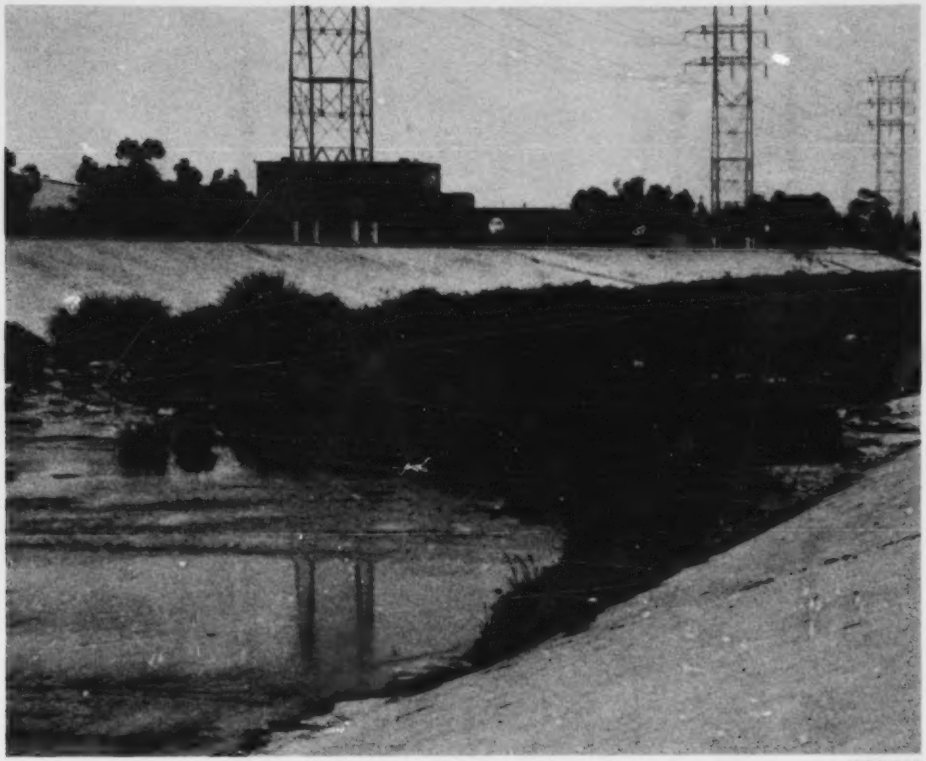
One of the objectives of providing treatment plants in the Valley is full reclamation of at least part of the high-quality wastewater for ultimate distribution to all classes of consumers. The tertiary treated wastewater would be spread in large surface basins (Figure II-53), allowed to percolate into the groundwater, and be withdrawn after a period of underground storage by wells for final treatment and distribution. Regardless of the timing of this operation, which is dependent on final decisions by the State Department of Health with respect to treatment levels and other requirements, some water from these treatment plants will infiltrate through stretches of the Los Angeles River that have unlined bottoms (Figure II-54).

Figure II-55 shows the wells, spreading grounds, and locations of existing or proposed treatment plants in the ULARA. Natural geologic processes have resulted in the deposition of coarser sediments in the eastern part of the basin, and finer sediments in the western portion. The eastern portion consequently has high permeability and good water yields, whereas the western portion has low permeability and poor water



198P-112

Figure II-53. Headworks spreading grounds in the San Fernando Valley. (The Valley Settling Basin experimental wastewater treatment facility can be seen in the background.)



198P-113

Figure II-54. Typical section of the Los Angeles River with unlined bottom and concrete-lined sides.

yields. Water moves slowly through the materials in the western half, and dissolves gypsum from a geologic stratum known as the Modelo formation, thereby resulting in high concentrations of dissolved solids. Motion of this water toward the pumping hole in the eastern basin has caused a progressive decrease in water quality, often termed the "Modelo Wave."

Groundwater extractions in the ULARA have been administered by the California Department of Water Resources as a Watermaster Service area as the result of legal determinations of water rights in 1968. Since that time, extractions have been limited to the safe yield calculated as 104,000 acre-feet per year (ac-ft/yr) for the entire ULARA, and 90,700 ac-ft/yr for the San Fernando Basin.

Los Angeles City has substantial rights to water in the ULARA. A State Supreme Court decision in 1975, which followed extensive litigation, affirmed the City's Pueblo Right to all groundwater in the San Fernando

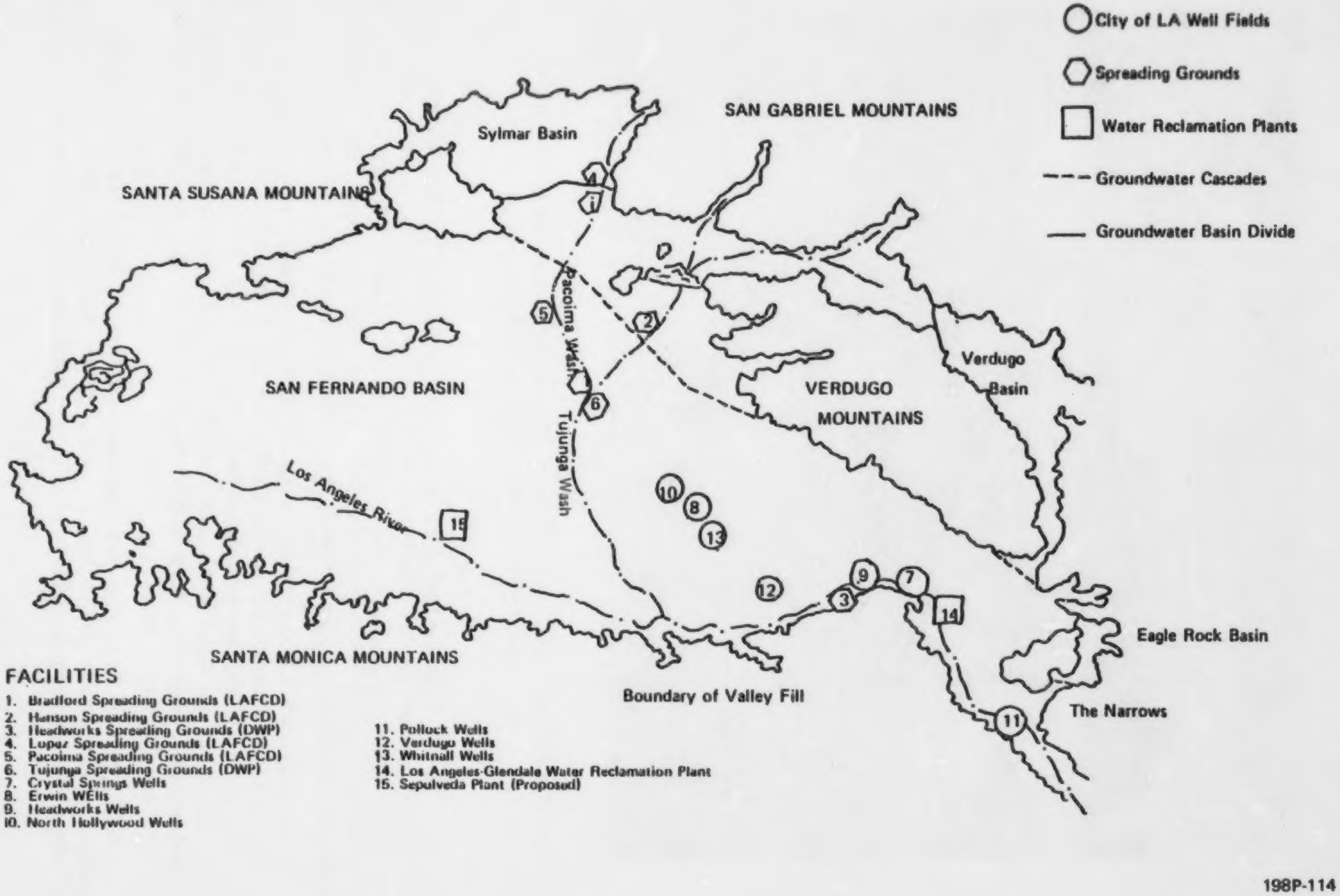

City of LA Well Fields
Spreading Grounds
Water Reclamation Plants
Groundwater Cascades
Groundwater Basin Divide
SAN GABRIEL MOUNTAINS
Sylmar Basin
SANTA SUSANA MOUNTAINS
Pacoima Wash
Tujunga Wash
SAN FERNANDO BASIN
VERDUGO MOUNTAINS
Verdugo Basin
Los Angeles River
Eagle Rock Basin
The Narrows
SANTA MONICA MOUNTAINS
Boundary of Valley Fill
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
FACILITIES
1. Bradford Spreading Grounds (LAFCD)
2. Hanson Spreading Grounds (LAFCD)
3. Headworks Spreading Grounds (DWP)
4. Lopez Spreading Grounds (LAFCD)
5. Pacoima Spreading Grounds (LAFCD)
6. Tujunga Spreading Grounds (DWP)
7. Crystal Springs Wells
8. Erwin WElls
9. Headworks Wells
10. North Hollywood Wells
11. Pollock Wells
12. Verdugo Wells
13. Whitnall Wells
14. Los Angeles-Glendale Water Reclamation Plant
15. Sepulveda Plant (Proposed)
198P-114

Figure II-55. Upper Los Angeles River basin wells, spreading grounds, and existing or proposed wastewater treatment plants (Department of Water and Power, April 1976).

Basin derived from precipitation and runoff from within the ULARA, or imported from outside the ULARA. The Cities of Glendale and Burbank have rights to recharged imported water used within their boundaries. The City was also given rights to part of the native water and to imported water in the Sylmar Basin. The expected allotments to the City after reassessment by the trial court are 86,000 ac-ft/yr in the ULARA, with 83,000 of this in the San Fernando Basin, increases of 30 percent and 31 percent over 1972 allocations, respectively.

A key point in the Supreme Court decision is that the City of Los Angeles can extract as much imported water from groundwater as it spreads, and the presumption is that similar rights would apply to the spreading and recovery of reclaimed water. "Conjunctive uses" are also possible, in which water is stored underground during periods of substantial supply, and withdrawn during periods of drought or other emergencies (Department of Water and Power, April 1976).

Such conjunctive uses have been applied to a minor extent in the past (i.e., more water was recharged in some years than was withdrawn), and more extensive practices of this type are planned for the future. For example, it has been proposed to export greater than average amounts of water from the Owens Valley Groundwater Basin during years of much above average runoff, and to spread that additional water in the San Fernando groundwater basin. During dry years, the Aqueduct flows would be cut back and the previously stored water would be pumped from the San Fernando groundwater basin. This project would involve construction of a pipeline connecting the outlet of MWD's San Fernando tunnel to the Pacoima Wash, to transport Aqueduct water to the Pacoima Spreading Grounds. There, it would be spread by the L.A. County Flood Control District pursuant to an existing agreement. The required pipeline would be approximately 900 feet long (DWP, May 1976).

The State Department of Water Resources has also proposed use of reserve space in the San Fernando Basin for the storage of SWP water. The proposal recommends that approximately 500,000 ac-ft of water be pumped into the basin over a period of 5 years. It is expected that this project will cause groundwater levels in the San Fernando Valley to rise but not to the historically high levels that existed in the early 1940s (DPW, 1975).

d. Precipitation and Runoff. Rain falling in the Los Angeles area contributes both to recharge of the groundwater basins and to runoff. The amount of water from a given storm that runs off, rather than enters the ground and contributes to groundwater recharge, is related in a complex way to such factors as:

1. The amount of ground exposed, its vegetative cover, and the steepness of the slopes on which the rain falls.

2. The condition of the soil near the surface; i.e., whether it is relatively porous or impervious; whether it is relatively dry and capable of absorbing moisture or already saturated by previous rains; and, at higher elevations, whether there is a snow cover, or whether the soil near the surface is both saturated and frozen.

3. The intensity and duration of the storm. Intense storms tend to produce rapid runoff, because the rate at which water is applied exceeds the capacity of the soils to absorb water. During long, gentle storms runoff tends to increase more slowly, with the soil-absorbing moisture until it becomes saturated before substantial runoff occurs.

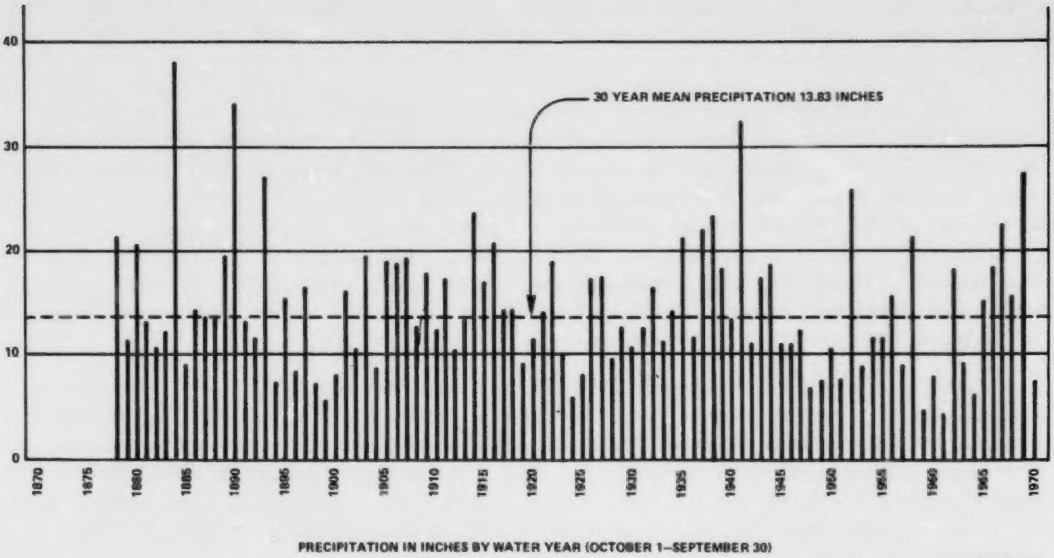
Two different basic conditions must be recognized in the Los Angeles region: those in the developed portion, where much of the area is covered by structures, streets, highways, and parking lots which render large areas impervious, and the undeveloped (principally hilly or mountainous areas) where most of the ground surface is relatively undisturbed.

There are also two concerns in routing and confinement of storm water runoff: the first is to prevent the loss of life and minimize property damage, and the second is to conserve as much of the water as possible for later use, typically through construction of reservoirs and retention basins, where water is stored during peak flow periods for either subsequent deliberate release or groundwater recharge. Many such structures serve dual purposes in minimizing flooding and contributing to recharge.

(1) PRECIPITATION. Precipitation in the Los Angeles River Basin is characterized by intermittent rain during winter months and negligible rain during summer months. Although precipitation normally occurs as rainfall, winter snow is common in the higher elevations of the San Gabriel Mountains. Snow in the coastal plains is extremely rare, but trace snowfalls have been recorded throughout most of coastal Los Angeles County. Most rainfall occurs during winter, with approximately 85 percent of the annual total falling from November through March.

As is typical of many semiarid regions, the Los Angeles River Basin experiences wide variations in monthly and seasonal precipitation totals. Local rainfall in any given month during the rainy season may be as much as four times the long-term monthly average for that month. Similarly, yearly precipitation totals also vary widely, as shown for the Los Angeles area in Figure II-56.

The amount of precipitation typically increases with distance from the ocean. Yearly averages range from 10 to 15 inches in the coastal plain to 20 inches in foothill areas, and 30 to 40 inches in the high mountains. With the exception of the Santa Monica Mountains, little increase in precipitation with increase in elevation occurs over the intermediate belt of hills separating the inland valleys from the coastal plain.



198P-115

Figure II-56. Precipitation record for Los Angeles, California (State Department of Water Resources, 1971).

To some degree, precipitation intensity parallels the pattern of total annual moisture. Therefore, intensity is in general greatest in mountain areas which receive the highest average yearly precipitations. The maximum intensity of precipitation for periods of 12 hours or longer at recurrence intervals of 10 to 100 years is greater in portions of the San Gabriel Mountains than in any other location in the continental United States. The maximum 30-minute rainfall which might be expected to occur once every 100 years on the average is more than 2.5 inches in the San Gabriels. Precipitation values in excess of 20 inches for a 24-hour period can be expected in these mountains once every 100 years. Two precipitation intensity records for the State of California are held by stations in the Los Angeles River Basin portion of the San Gabriel Mountains. Opid's Camp, elevation 4,254 feet, received a record 0.65 inch of rain in 1 minute on April 5, 1926. The record for daily precipitation is at Hoegee's Camp Ivy, elevation 2,750 feet, where 25.83 inches of precipitation fell on January 22, 1943.

(2) RUNOFF. Facilities to control runoff and minimize flooding in the urbanized areas are provided by both the City and County Flood Control Districts, although the activities of the Los Angeles County Flood Control

District also extend into the foothill areas. The U.S. Army Corps of Engineers is responsible for the improvement of the larger streams running through the City and contiguous areas of the County. The U.S. Army Corps of Engineers projects are constructed to provide protection against 100-year storms.

The City and County Flood Control Districts normally design their underground drainage facilities to provide relief from the effects of a storm of 10-year severity (i.e., a storm that will occur, on the average, once in every 10 years). Along watercourses and sumps (areas of interior drainage where water ponds after a storm), relief from 50-year storms is provided. City streets act as drains where underground drains are not installed. When new subdivisions are developed, storm drains are required when the expected runoff from a 10-year storm will render streets unusable (Planning Department, Los Angeles City, June 1973).

As noted earlier, there is a direct relationship between flooding and wastewater collection and treatment. Flooding tends to contribute to increased wastewater flows, through direct inflow of storm water into the wastewater collection system (e.g., through inundated manhole covers). Rain-induced saturation of the soil around incompletely sealed sewer pipes also can contribute to increased flows by infiltration, although this condition is not necessarily related to flooding.

Figure II-57 shows the major drainage and flood control facilities within the Basin, and the areas of potential inundation and heavy flooding. The U.S. Army Corps of Engineers operates a major system of flood control dams and flood control channels in the Basin. Its five flood control dams are located on major valley watercourses and are designed and operated to contain peak discharges and regulate downstream flow. The Corps operates and maintains parts of the Los Angeles River and San Gabriel systems. Nearly all of the flood control channels are lined, minimizing groundwater recharge via channel-bottom percolation.

The largest system of public works within the Basin is that of the Los Angeles County Flood Control District (LACFCD) which includes storm drains, flood control channels, debris basins, dams, spreading grounds and seawater intrusion barriers. The system is coordinated with the flood control works of the U.S. Army Corps of Engineers. Dams are situated on major mountain streams, frequently incorporating water conservation features as well as flood control capability. The 72 debris basins collect mud and rock flow debris at canyon mouths of tributary streams in the mountain foothills. Flood Control channels are integrated with the Corps of Engineers channels for a combined length of 390 miles in the system. The 1,200 miles of storm drains are used to drain urban developed areas into major drainage channels or directly to the Pacific Ocean. Groundwater replenishment occurs through percolation of usable runoff and other waters from spreading grounds.

Los Angeles City proper was underlain by approximately 1,300 miles of storm drains in 1968. These drains either funnel runoff into the large

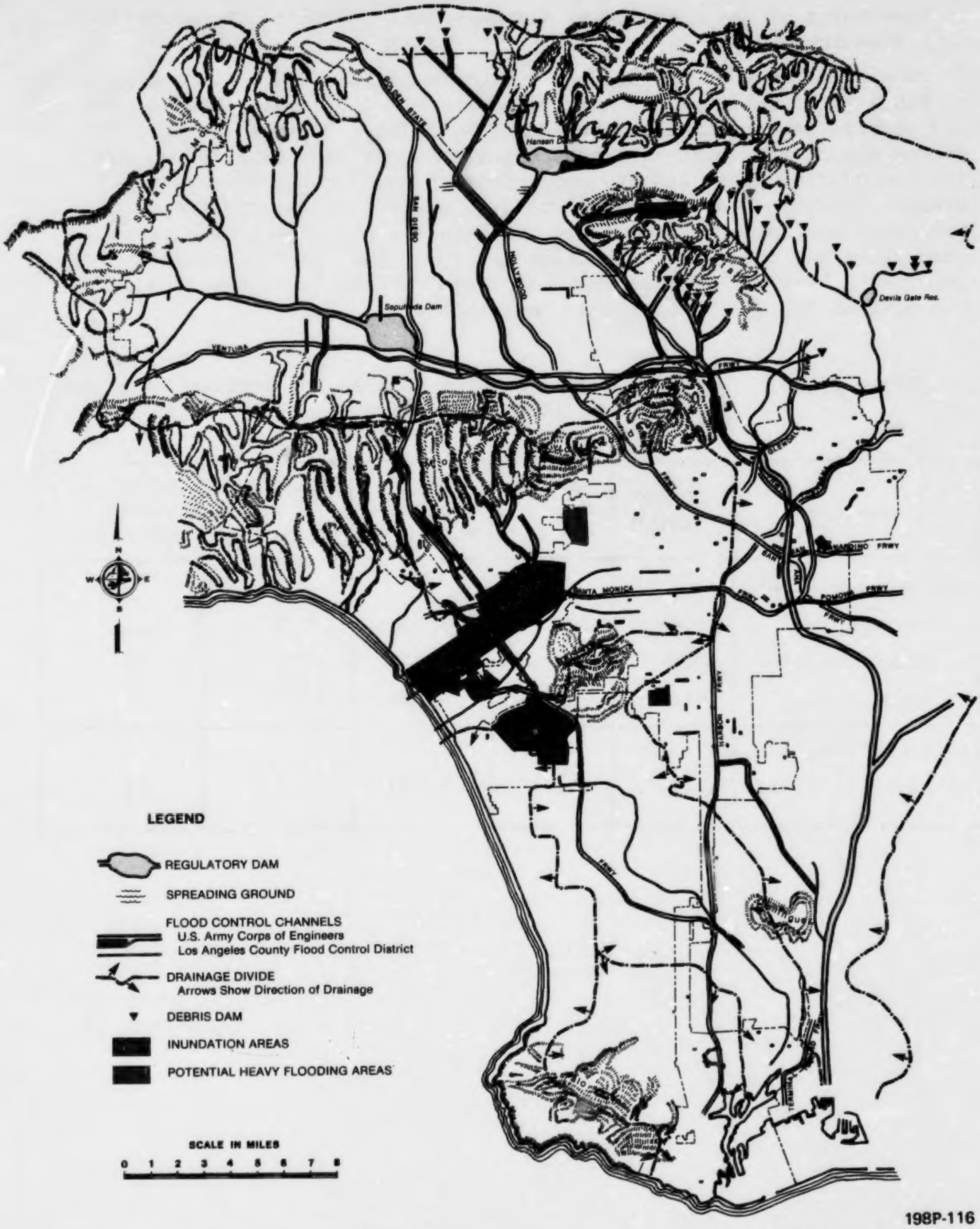

Hansen Dam
Golden State
San Diego
Hollywood
Sepulveda Dam
Devils Gate Res.
Ventura
Frwy
Santa Monica
San Bernardino Frwy
Pomona Frwy
Harbor Frwy
N
W
E
S
LEGEND
REGULATORY DAM
SPREADING GROUND
FLOOD CONTROL CHANNELS
U.S. Army Corps of Engineers
Los Angeles County Flood Control District
DRAINAGE DIVIDE
Arrows Show Direction of Drainage
DEBRIS DAM
INUNDATION AREAS
POTENTIAL HEAVY FLOODING AREAS
SCALE IN MILES
0 1 2 3 4 5 6 7 8
198P-116

Figure II-57. Major flood control facilities and potential inundation and heavy flooding areas in the Los Angeles Region (Planning Department, City of Los Angeles, 1973).

open channels of the Flood Control District and Corps of Engineers, or, in some parts of the City, empty directly into the ocean (Department of City Planning, N.D.).

The efficiency of the present system is indicated by the data presented in Table II-17 based on Los Angeles County Flood Control District records and gauging station calibrations (LACFCD, 1975). This table shows the stream depth that would be expected for the peak flow experienced during the record flow year, and the approximate present total channel depth. Gauge calibrations do not extend to full channel depth, and the results indicated are conservative, i.e., the channels would carry much more than twice the flow with a doubling in depth, and are thus capable of carrying substantially more than twice the maximum flows experienced in the periods for which records are available.

Table II-17. Selected gauging station data on Los Angeles River and Ballona Creek (LACFCD, 1975).

STATION	RECORD LENGTH	YEAR OF MAX. FLOW	MAX. DAILY FLOW (cfs)	APPROX. FLOW DEPTH (ft)	APPROX. MAIN CHANNEL DEPTH (ft)
Los Angeles River					
Tujunga Ave.	1950-74	1968-69	19,000	9.8	19
Firestone Blvd.	1928-74	1937-38	40,000	7.5	17
Wardlow Rd.	1955-74	1968-69	55,000	11.2	22
Ballona Creek					
Sawtelle Blvd.	1928-74	1937-38	7,330	6.8	23

D. terrestrial biology

II-137

D. TERRESTRIAL BIOLOGY

1. AREAWIDE TERRESTRIAL AND AQUATIC BIOLOGY

An overview of the terrestrial biology in Los Angeles is presented in Section I.C.3. In this section, the characteristics of the areawide terrestrial and freshwater biology that are subject to alteration as a result of implementation of the Facilities Plan are discussed.

Implementation of the Facilities Plan could alter the terrestrial and freshwater biology in Los Angeles by three general mechanisms:

1. Alteration of the biology on facilities sites resulting from construction, landscaping, and aspects of operation of the facilities.
2. Alteration of offsite biology by direct emissions from the facilities sites. The most likely such alterations could occur in the riverbeds to which some of the facilities will discharge treated wastewater; or to terrestrial areas such as Griffith Park which will be irrigated by reclaimed water.
3. Alteration of offsite biology resulting from secondary effects of the facilities. For example, if the facilities influence the construction of new housing in areas where houses did not previously exist, terrestrial biology in those areas will be altered, or if implementation of the Facilities Plan increased traffic and consequently increased oxidant levels in the air reaching the pine forests of the Los Angeles National Forest, then damage to forest trees could result.

The significance of the alterations of the terrestrial/freshwater biology depends on a subjective judgment of the importance of the existing biology at areas to be affected. One such selection of areas of ecological importance is shown in Figure II-58, from the City of Los Angeles Conservation Plan. The areas identified include only those of fairly large geographic size which are presently either undeveloped, developed as parks, or reverting slowly to a natural state (such as the airport dunes). To these might be added the unlined sections of the Los Angeles River which, although narrow, provide an unbroken linear corridor of vegetation of value to a variety of animals; areas of agricultural land

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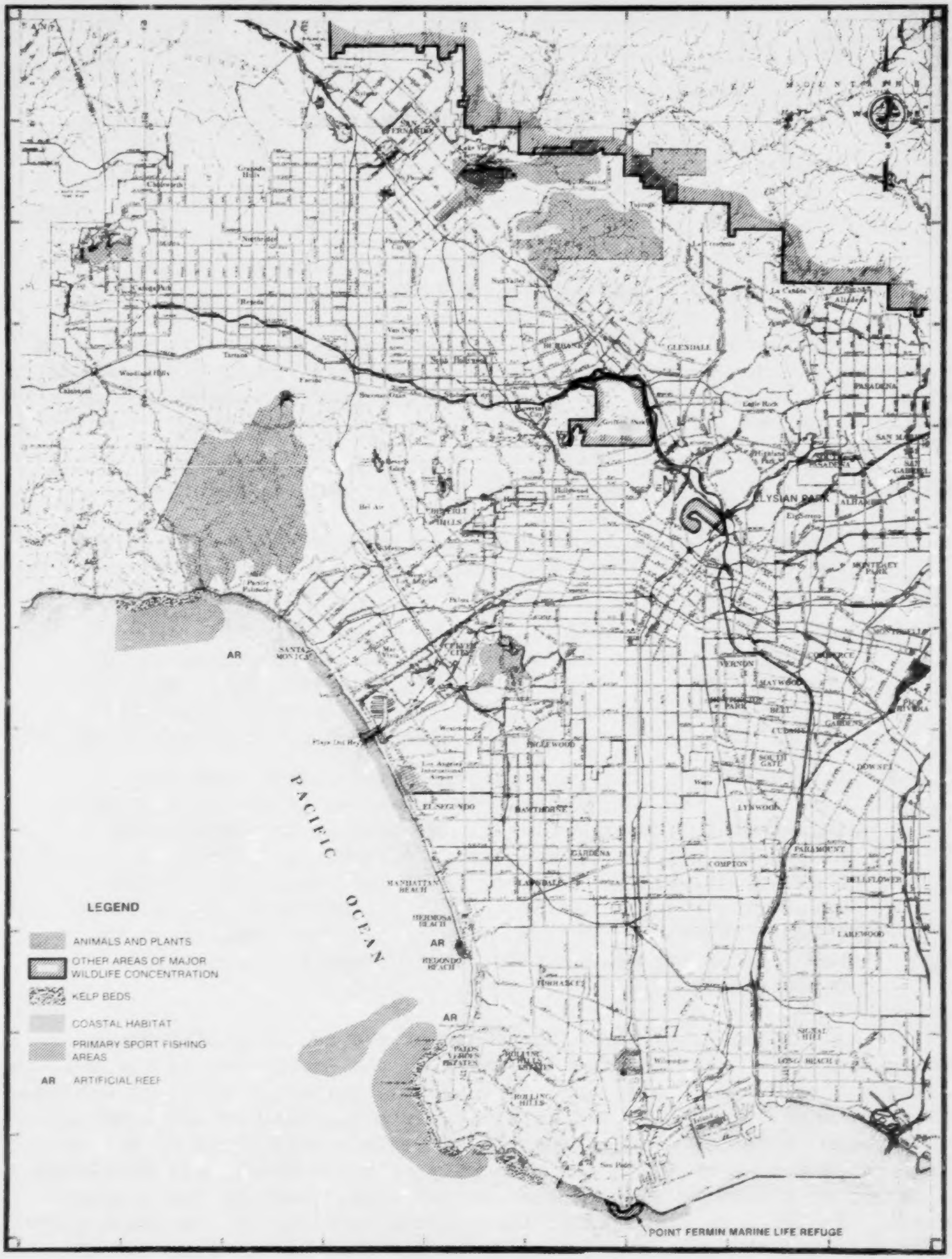
LEGEND
▨ ANIMALS AND PLANTS
▨ OTHER AREAS OF MAJOR WILDLIFE CONCENTRATION
▨ KELP BEDS
▨ COASTAL HABITAT
▨ PRIMARY SPORT FISHING AREAS
AR ARTIFICIAL REEF
PACIFIC OCEAN
AR
AR
AR
SANTA MONICA
BEVERLY HILLS
GLENDALE
PASADENA
ELYSIAN PARK
VERNON
INGLEWOOD
EL SEGUNDO
HAWTHORNE
GARDENA
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
COMPTON
LYNWOOD
SOUTH GATE
DOWNEY
PARAMOUNT
BELLFLOWER
LAKEWOOD
SIGNAL HILL
LONG BEACH
POINT FERMIN MARINE LIFE REFUGE

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Figure II-58. Ecologically important areas.

and of golf courses (such as those within the Sepulveda Flood Control Basin) which provide an animal habitat not found elsewhere in the Los Angeles vicinity; heavily vegetated residential areas such as Beverly Hills, which with their complex vegetation and human source of food provide a productive bird habitat; and wetlands in various states of management (such as those adjacent to Ballona Creek near Marina del Rey) which are representative of a coastal habitat that has all but disappeared in Southern California.

The natural areas in National Forests do not depend on artificially supplied water and any effects of the Facilities Plan on them will be the result of altered public utilization and of altered air quality. The Angeles National Forest in the San Gabriel Mountains and the San Bernardino National Forest in the San Bernardino Mountains, both contain populations of a number of trees (Griffen and Critchfield, 1972) known to be sensitive to photochemical smog (Williams, undated) including *Abies concolor* (California white fir), *Calocedrus decurrens* (incense cedar), *Quercus kelloggii* (California black oak), *Pinus lambertiana* (sugar pine), *P. flexilis* (limber pine), *P. attenuata* (knobcone pine), *P. jeffreyi* (Jeffrey pine), *P. ponderosa* (ponderosa pine), and *Pseudotsuga macrocarpa* (bigcone Douglas fir). The injuries produced by oxidant smog are most severe on ponderosa and Jeffrey pines (Williams, undated). Oxidant induced damage to black oaks, ponderosa pines, and Jeffrey pines has been mapped in the San Bernardino Mountains for 1974, (Statewide Air Pollution Research Center, undated), and a relationship has been drawn between damage and total seasonal oxidant dose. There is a clear relationship between the accumulated dose of oxidant in ponderosa pine saplings and the visible injury. Studies of oxidant damage are not available for the San Gabriel Mountains, but it can be assumed that the trees there have the same sensitivity to oxidants.

Other areas of natural vegetation, less sensitive to the effects of air pollutants, and not requiring water (other than that from natural precipitation) for maintenance include areas such as the Baldwin Hills and the Airport Dunes.

Many areas of biological interest do require water for maintenance and those include residential, agricultural, and landscaped park areas as well as river bottoms, estuarine zones, and wetlands. In these areas the type of vegetation and animals present as well as their numbers is strongly related to the amount of water supplied. Through the release of treated water from the Sepulveda Facility and from LAGWRP into the Los Angeles River, the plant and animal associations of the unlined river bottom and of the estuarine zone could be substantially affected. A continuous flow of water would continue to support a lush riparian association (such as Basin to the Los Angeles Narrows) and would encourage the development of a brackish water biota at the mouth of the river. A continuous flow sufficiently large to spread out of the low-flow section in lined portions of the river could encourage nuisance algal blooms and a nuisance mosquito population. These phenomena are discussed under the Los Angeles River heading below.

A continuous flow of water from the proposed La Cienega Facility into Ballona Creek could alter the estuarine benthic communities that presently exist in the creek and could, if diverted, alter the characteristics of the wetlands adjacent to the creek. Ballona Creek is also discussed under a separate heading below.

If all of the treated wastewater were to be used for irrigation (of parks, golf courses, agricultural land) rather than released to the natural water courses, then a considerable amount of land could be irrigated or a smaller amount irrigated more intensively (altering the existing vegetation). Alternatively, the existing need for increased importation of water (exemplified by the Department of Water and Power's recent decision to increase the pumping of groundwater in the Owens Valley) could be diminished by replacing imported water with reclaimed water. The whole question of water reclamation will be discussed in a supplement to this report.

2. SITE SPECIFIC TERRESTRIAL AND AQUATIC BIOLOGY

a. Hyperion Treatment Plant. The Hyperion Treatment Plant is located on the eastern edge of Santa Monica Bay. The land on which the plant is built has been owned by the City of Los Angeles since the Nineteenth Century. This long period of use and occupancy has altered the site so completely that it bears little resemblance to the coastal dune habitat that originally existed.

An extensive well-tended lawn area extends the full length of the Hyperion Treatment Plant site between Vista del Mar Boulevard and the treatment plant buildings. The area around the buildings, tanks, and along the internal roads are planted with a wide array of species, predominantly Australian shrubs and mixtures of many other trees and groundcovers, including some native species. The slopes, particularly to the east and south, are covered with vigorous healthy vegetation, and are well watered by an extensive sprinkler system. The most abundant landscape species include laurel sumac, sea fig, other iceplants (*Mesembryanthemum* sp.), *Leptospermum* sp., bottlebrush (*Melaleuca* sp.), *Pittosporum* sp., oleander (*Nerium oleander*), *Acacia* sp., *Eucalyptus* sp., *Ficus nitida, Lantana montevidensis,* ivy (*Hedera helix*), and Transvaal daisy (*Gerbera jamesonii*).

The slopes on the east and south areas of the plant are vegetated predominantly by weedy introduced species with some weedy native species. The eastern slope, being higher and longer, supports a more diverse flora than does the south slope. The most common species are sea fig (*Carpobrotus aequilaterus*) which forms a dense, succulent groundcover, and laurel sumac (*Rhus laurina*) which occurs as a shrub from 1 to 4 meters high. This plant, a native species, may occur on the slopes as a remnant of native vegetation or may have been introduced from the plant grounds where it is cultivated. Beachgrass (*Ammophila arenaria*), California buckwheat (*Eriogonum fasciculatum*), and *Stephanomeria virgata* also occur in smaller stands throughout the face of these slopes. Along the road at the top of these bluffs *Myoporum laetum* is a common large shrub and Russian thistle (*Salsola kali*) occurs as a low shrub. Wild oats (*Avena fatua*) and Bermuda grass (*Cynodon dactylon*) are two of the more common species of weedy grasses which are found throughout the areas.

The vegetation on the east side of the Hyperion property line on the east bluff is slightly more representative of the native vegetation, owing partially to the lack of landscaping. Common coastal strand species occur, including silver beachweed (*Ambrosia chamissonis*), with san verbena (*Abronia maritima*) and bush lupine (*Lupinus chamissonis*). These natives are interspersed with weedier species common to waste areas, including telegraph weed (*Heterotheca grandiflora*), saltbush (*Atriplex* sp.), sow thistle (*Sonchus asper*), goosefoot (*Chenopodium* sp.), and wild mustard (*Brassica campestris*). If any of the existing vegetation on these bluffs were disturbed or removed, it is likely that the same species would revegetate this area.

The old fields or vacant lots on the site support a depauperate weedy flora with species such as telegraph weed, *Baccharis douglasii,* Castor bean (*Ricinus communis*), tomato (*Lycopersicum esculentum*), wild mustard, and Russian thistle. This old field vegetation is adventive, and if it were removed, seed from adjacent populations of the same types of vegetation would probably produce replacements.

A limited access portion of the coastal strand and dune community does exist across Imperial Highway on Los Angeles International Airport property. The natural vegetation of this dune community is composed of low succulent perennial shrubs and woody perennials. Characteristic plants include shore silver beachweed (*Ambrosia chamissonis*), lupine (*Lupinus chamissonis*), Calabazilla (*Curcurbita foetidissima*), *Haplopappus ericoides, Lathyrus littoralis, Abronia maritima,* beach primrose (*Camissonia cheiranthifolia*), and the grass, *Poa douglasii.* The California Coastal Plan (1975) advocates allowing the Airport Dunes, just north of the Hyperion Treatment Plant, to revert to their natural state to serve as habitat and for educational uses and compatible recreation.

West of the plant, across Vista del Mar, there is a steep bluff which supports predominantly landscape vegetation, almost exclusively sea fig. At the base of the bluff, typical coastal strand species occur along with sea fig, including silver beachweed and occasional dune grass. Much of the beach area is landscaped, some areas being grass lawns. Most of the native and weedy vegetation exists on areas which are too steep or otherwise unsuitable for landscaping. The California Coastal Plan (1975) recommends that bluffs in this area, presumably including those east and west of Hyperion, be acquired to increase public visual access and reserve natural land forms.

The vegetation of the Hyperion Treatment Plant site, in contrast to the botanically impoverished land surrounding it on three sides, gives it the effect of an oasis to the local avifauna. The presence of free and available water from the sprinkler system probably contributes substantially to its attractiveness to birds, particularly during the drier months of the year. A one-hour observation of the birds on 15 October 1975 indicated that the habitat provided by the vegetation of the Hyperion Treatment Plant in immediate proximity to the shore, dune, and marine habitats supports a variety of bird species. The lawn area acts as an interface which is utilized by certain shorebirds and gulls, as well as passerines. The 22 species of birds recorded in the brief observational period are listed in Appendix III-B.

Observations over longer periods and throughout the year would likely extend this list to include all the shorebirds and species of gulls characteristically found along the Southern California coast. Scoters and western grebes would be expected to rest on water beyond the surfline, and species of terns would similarly be expected to fish in that area. The oasis and refuge for land birds provided by the vegetation of the plant site should be attractive to a much broader range of resident and migratory land birds than listed here.

The completely fenced area of the Hyperion Plant may offer cottontail rabbits a refuge from certain predators for they are common to the area. No other mammals were observed, although unidentified scats were found and tracks of domestic cats were present. The thick grass cover on portions of the slopes should provide cover and very suitable habitat for species of rodents. No lizards or other reptiles or amphibians were seen, although they are probably present as the habitat is proper.

Insects are commonly abundant and diverse. Butterflies were most obvious, although bees, wasps, and dragonflies were also evident. The flying butterflies included monarchs, mourning cloaks, skippers, lycaenids, and pierids. The only ant species seen were colonies of Argentine ants, *Iridomyrmex*.

The coastal dunes to the north of Hyperion provide habitat for a number of organisms including the El Segundo blue butterfly which was declared an endangered species on 1 June 1976. This butterfly originally inhabited an area of approximately 96 km^2 (36 square miles) known as the El Segundo Sand Dunes. Its present range is limited to the relatively unaltered dunes located at the west end of El Segundo Boulevard (2 acres owned by Standard Oil) and at the west end of the Los Angeles airport runways (J. Donahue, 9 February 1977). Almost all of the 243 acres of dunes on the airport property have been included in a proposed critical habitat by the U.S. Department of Interior on 8 February 1977 (J. Donahue, 22 February 1977). Coastal buckwheat (*Eriogonum parvifolium*), which grows in the dunes, is the only food of the El Segundo blue larvae. The flowers and seeds of this plant are eaten by the larvae, and the adults feed mainly on its nectar.

Vertebrate species inhabiting the dunes include two reptiles, the California legless lizard (*Anniella pulchra*) and the coast horned lizard (*Phrynosoma coronatum*), both protected by California law, and one mammal, the Cantwell pocket mouse (*Perognathus longimembris cantwelli*). Other mammals characteristic of this habitat are the harvest mouse (*Reithrodontomys megalotis*), the deer mouse (*Peromyscus maniculatus*), and the raccoon (*Procyon lotor*).

b. Terminal Island Treatment Plant. The Terminal Island Treatment Plant is situated in an area which has been subjected to years of intensive heavy industrial activity, major site alterations, landfills, and other changes in its original state. Since few species of organisms are adapted to survive in such an environment, the lists (in Appendix III-B) of plants, mammals, and reptiles which are found at the site is not lengthy. The plant species occurring in the vicinity of the Terminal Island Treatment Plant include a high proportion of adventive, weedy, and resilient forms well adapted to exist in an environment that is hostile to many characteristic Southern California plants and animals. No rare or endangered plant species occur in the area of the Terminal Island Treatment Plant. The closest ecologically important area as designated in the Los Angeles City Conservation Plan is the Point Fermin Marine Life Refuge about 3 miles to the southwest.

The list of birds observed at the site indicates that the number of bird species present is greater than that of other vertebrates; however, most of the bird species on the list are not dependent on the site for feeding or nesting, and the habitat ranges of most of these species greatly exceed the site area. The industrial environment at the site is not particularly attractive to migratory species which seasonally move along the south coast. The natural requisites of such species are generally lacking at the site.

A 1973 report on the terrestrial biology of a proposed LNG site south of the Terminal Island Treatment Plant provides some information on the biota of that area (Dames and Moore, 1973). At that time, the portions of the site most significant to fauna were two brackish impoundments resulting from uneven fill placement and rain water. These served as temporary resting and feeding areas for several species of shore birds. In addition to the 22 species of birds observed during two surveys (28 September 1972 and 25 January 1973), as many as 137 or more species may potentially use the site during some time of the year (Dames and Moore, 1973).

Of these avian species, several are uncommon, restricted in range, or considered endangered species. The latter include the brown pelican, the Belding savannah sparrow, and the least tern. In 1973 and 1974, least terns were observed courting on the ground, but were then prevented from nesting by landfill and grading operations. In 1975, however, it became a breeding colony consisting of approximately 24 pairs with a good degree of nesting success (Massey, 1975). As vegetation began to cover the disturbed landfill, no open area suitable for nesting by least terns remained, and no nests were found in that area the following year (1976). Instead, a colony of about 60 nesting pairs of least terns was found on Reeves Field, an abandoned naval facility (R. Jurek, 25 March 1977).

The marsh habitat in which Belding savannah sparrow breeds does not exist in the area of the Terminal Island Treatment Plant. The brown pelicans are in the area and feed in the harbor, although their nesting sites are offshore on the Channel Islands.

The observations of greatest relevance to the Terminal Island Treatment Plant's present and future operations are as follows:

> Two primary food sources are utilized by birds occupying the LNG site. One feeding area centers around the upwelling of treated sewage from the Terminal Island sewage treatment facilities outfall. This outfall virtually bisects the LNG site, terminating about 100 yards offshore in shallow water. The sewage released receives only primary treatment and birds feed on organisms attracted to the outfall. The second feeding area is a small sandy embankment west of the LNG site. This unprotected embankment is formed at the intersection of two riprap dikes, and is only about 20 yards from two short outfalls which discharge raw fish cannery waste. Enough organic material exists in these effluents to support sizeable bird populations.
>
> The characteristics of the outfalls which now makes them attractive to birds will soon disappear. Stringent water quality standards are now being applied within the harbor, standards which will require further treatment of effluents. With secondary or tertiary treatment of effluents, particulate loads will decrease and, so presumably, will the bird life utilizing these energy sources.
>
> Terminal Island is an area of intense industrial activity. Habitat alteration, in the form of land reclamation and building, undoubtedly long ago displaced most of the more important endemic terrestrial organisms. It is, therefore, highly unlikely that all of the organisms included in the species list will be found to occur here. Only the birds which may transiently utilize the area appear to be of general significance (Dames and Moore, 1973).

c. Los Angeles-Glendale Water Reclamation Plant. The Los Angeles-Glendale Water Reclamation Plant (LAGWRP) is located on a site surrounded on on its north, east, and south by small industrial plants, foundries, and warehouses. The Los Angeles River is channelized at the Los Angeles-Glendale Treatment Plant site and has a cross section that is trapezoidal with concrete-lined sides and a permeable sand and cobblestone invert which permits percolation. Access to the River is prevented by a fence which also extends around the entire site.

Between the main building and the River, and along the paths and roadways, there is an expanse of lawn in which redwood trees and other ornamentals are planted. Weedy vegetation occurs at various places within the site where the ground has been disturbed by construction activities. On 15 October 1975 an onsite survey showed that most of this weedy vegetation was dry and dead, although some hardy annuals still persisted along with a few perennial species such as mulefat (*Baccharis viminea*).

The native vegetation of the area at the Los Angeles-Glendale Water Reclamation Plant has been long removed. Originally, it was probably a dry, open coastal sage scrub which bordered on a then unchannelized Los Angeles River. Industrial development has removed all of this vegetation in the immediate plant vicinity. The excavated basin in the center of the plant property supports a small weedy flora of mulefat, willows (*Salix* sp.), dock (*Rumex crispus*), Russian thistle, sunflower (*Helianthus annuus*), Caltrop (*Tribulus terrestris*), tumbleweed (*Amaranthus alba*), and tree tobacco (*Nicotiana glauca*). These plants are adventitious weeds and common to most of the highly disturbed vacant lots in the area. If these plants were removed for any reason, it is probably that the same general species would be the first to reappear.

Mourning doves were present in considerable number (15 October 1975 survey), feeding on the floor of the weedy basin where seeds were especially plentiful, and Brewers blackbirds were on the lawn. Redwinged blackbirds were on the cattails, rushes, and willows growing in the River bottom, and two kildeer were at the water's edge. No evidence of mammals nor reptiles was found, but the western toad (*Bufo boreas*) was common in the wet area of the lawn and groundcover plantings. The most obvious insects were numerous grasshoppers and damselflies. There were a few dragonflies and some butterflies, including skippers, white cabbage butterflies, and one yellow alfalfa butterfly (*Colias eurytheme*).

This is not a lengthy faunal list, nor is it likely that one could be compiled for this site. The species most probably found in the area are those commonly inhabiting industrial, business, and poorly maintained residential areas outside the inner urban core, with a few additional species present because of the proximity to the River. None of these are rare or endangered.

d. Sepulveda Water Reclamation Plant. The proposed site for the Sepulveda Facility is in the San Fernando Valley within the large flood control Sepulveda Basin formed by the Sepulveda Dam. The proposed site is bordered on the north by a military installation for an air wing of the California National Guard. To the east is a minor drainage area tributary to the Los Angeles River and further east is a wall of the Sepulveda Dam and the Santa Monica Freeway. To the south and west is an area developed as a park. To the west, across Woodley Avenue, is a public golf course. Far to the south of the site, across the Sepulveda Basin, is the spillway of the Sepulveda Dam, the southerly wall of the Dam, and the Ventura Freeway. Burbank Avenue also runs through this area of the Basin.

The site was surveyed for existing flora and fauna on 15 October 1975. At that time, part of the site was agricultural land with a maturing corn crop, while another portion had been disced and was lying fallow.

Two small buildings are on the site, one of which serves as a maintenance storage and shop for the equipment used to service the golf course. The other structure apparently serves the farming activity. The floor of the Basin is essentially level with several drainage channels running through it. The park areas are planted with lawns, and together with the golf course, are well tended and kept green. Trees have been planted in these grassy areas, and the picnic tables in the vicinity receive heavy use.

The original vegetation of this area was probably a dry version of coastal sage scrub, intermixed with river wash vegetation; however, this general area has been under agricultural, residential, or industrial development for a sufficient time that few remnants of native vegetation remain on the site. The majority of the site is filled or planted with corn. At the edges of the cornfield,there are small numbers of weedy species, such as *Amaranthus* sp., Russian thistle, cheeseweed (*Malva parviflora*), sweet clover (*Melilotus alba*), sunflower, and species of weedy grasses.

The most common species of plants in the drainage channel which flows north-south on the east side of the site, are cattail (*Typha angustifolia*), giant reed (*Arundo donax*), dock (*Rumex crispus*), bulrush (*Scirpus acutus*), and mulefat. Since there was water in the creek in mid-October, it probably has a continuous source of water all year. Hence, the ditch is capable of supporting perennial species which do not die back each year.

A one-half hour transect of the site showed the presence of mourning doves, horned larks, meadow larks, Brewers blackbirds, and rock doves. The list is limited by the absence of trees or shrubs at the site. No mammals, reptiles, or amphibians were observed, although the basin provides habitats suitable for the common species characteristically found in the San Fernando Valley.

e. The Los Angeles River.

(1) UPRIVER FROM THE LOS ANGELES NARROWS. The Los Angeles River above the Los Angeles Narrows is mostly an unlined channel (Figure II-59). In some areas the sides are concrete but the bottom is cobble and sand (ESI & KKI, 1969). The channel from 1.6 km (1 mile) above to 8 km (5 miles) below the Los Angeles-Glendale Water Recovery Plant (LAGWRP) has a permeable bottom with a percolation capacity of 0.4 m^3/sec (13 cfs). The volume capacity of this section of the channel is 2,230 m^3/sec (78,800 cfs). Five km (3 miles) above the LAGWRP is a rubber diversion dam operated by the Department of Water and Power to divert water to the Headworks Spreading Grounds. All of the river flow, except storm flows, are diverted so that the flow below the dam is a result of wastewater discharges (see Table II-18). The river is generally fenced although equestrian trails exist, and children play in the channel (ESI & KKI, 1969).

There is a scarcity of field data on the aquatic ecosystem in the upper Los Angeles River. In view of this, a survey of the plants and

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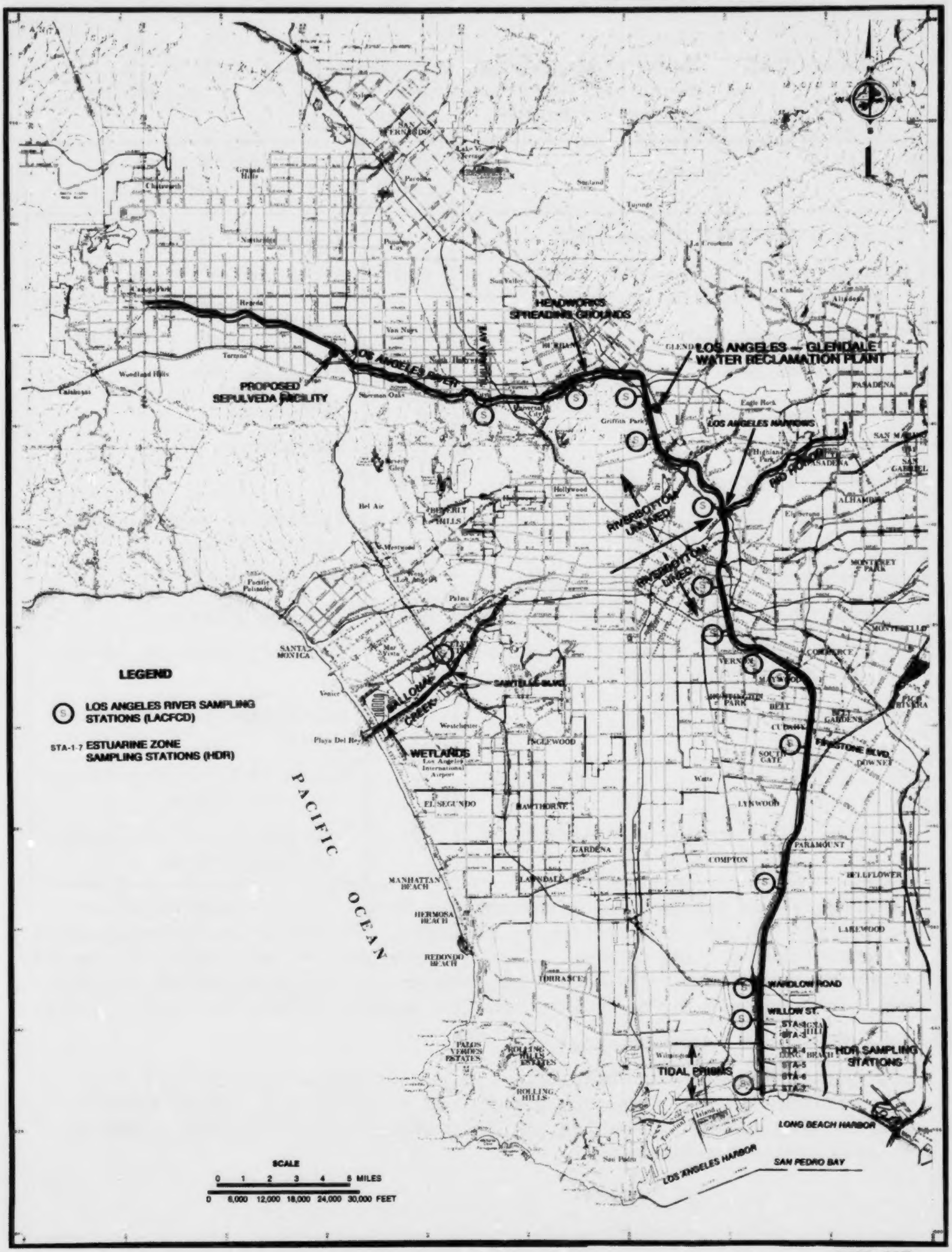
HEADWORKS SPREADING GROUNDS
LOS ANGELES — GLENDALE WATER RECLAMATION PLANT
LOS ANGELES RIVER
PROPOSED SEPULVEDA FACILITY
SEPULVEDA AVE
LOS ANGELES NARROWS
RIO HONDO
RIVERBOTTOM UNLINED
RIVERBOTTOM LINED
BALLONA CREEK
SAWTELLE BLVD
WETLANDS
FIRESTONE BLVD
WARDLOW ROAD
WILLOW ST.
STA-1
STA-3
STA-4
STA-5
STA-6
STA-7
HDR SAMPLING STATIONS
TIDAL PRISMS
LONG BEACH HARBOR
LOS ANGELES HARBOR
SAN PEDRO BAY
PACIFIC OCEAN
LEGEND
S LOS ANGELES RIVER SAMPLING STATIONS (LACFCD)
STA-1-7 ESTUARINE ZONE SAMPLING STATIONS (HDR)
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
Canoga Park
Reseda
Tarzana
Woodland Hills
Calabasas
Northridge
Van Nuys
Sherman Oaks
North Hollywood
Sun Valley
Tujunga
La Crescenta
La Cañada
Altadena
GLENDALE
BURBANK
PASADENA
Eagle Rock
Griffith Park
Universal City
Highland Park
SOUTH PASADENA
SAN MARINO
SAN GABRIEL
ALHAMBRA
El Sereno
MONTEREY PARK
MONTEBELLO
Hollywood
Bel Air
BEVERLY HILLS
Westwood
West Los Angeles
Palms
Pacific Palisades
SANTA MONICA
Mar Vista
Venice
Playa Del Rey
Westchester
Los Angeles International Airport
INGLEWOOD
EL SEGUNDO
HAWTHORNE
GARDENA
LAWNDALE
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
Wilmington
San Pedro
Terminal Island
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
COMMERCE
BELL GARDENS
PICO RIVERA
SOUTH GATE
DOWNEY
Watts
LYNWOOD
COMPTON
PARAMOUNT
BELLFLOWER
LAKEWOOD
SIGNAL HILL
LONG BEACH

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Figure II-59. The Los Angeles River with the locations of the Sepulveda Wastewater Reclamation Plant and the Los Angeles-Glendale Water Reclamation Plant (LAGWRP). Routine water quality sampling stations are shown as well as the HDR stations sampled in May 1976 (modified from EIS & KKI, 1969).

Table II-18. Summary of probable wastewater discharges to the Los Angeles River below the diversion dam at Headworks Spreading Grounds.[1]

SOURCE	FLOW (mgd)[2]	DESCRIPTION OF WASTEWATER
Lockheed Aircraft Corporation	2.3	Industrial waste
Burbank Water Reclamation Plant Burbank Generating Plant	4.0[3]	Secondary effluent Cooling tower blown down
Glendale Steam Plant	0.4	Cooling tower blown down
Los Angeles Zoo	0.5	Miscellaneous
Don Baxter, Inc.	0.1	Rinse water
Alumtreat, Inc.	0.1	Rinse water
Fibreboard Paper Products	2.8	
Swift and Company	0.2	Industrial waste - edible oil refining
Anchor Hocking Glass Corporation	0.4	Cooling water
American Pipe & Construction Company	0.1	Cooling water
Total of 130 Miscellaneous Dischargers within City of Los Angeles	0.8	Basically cooling water
Lever Brothers	0.1	Miscellaneous industrial waste
Oil Operator, Inc.	4.0	Oilfield brine discharged to Tidal Prism
Standard Oil Company of California	1.1	Oilfield brine discharged to Tidal Prism

[1] Table based on discussions with Regional Water Quality Control Board No. 4, LACFCD, Los Angeles County Engineer, Industrial Waste Departments of the cities of Los Angeles, Glendale, Burbank, Vernon, Bell, Paramount, Compton, Long Beach, Lynwood. Complete and up-to-date records are not available for all discharges to the Los Angeles River (ESI & KKI, 1969).

[2] Some flows are intermittent.

[3] The Burbank Generating Plant uses 2.5 mgd of secondary effluent from the Burbank Water Reclamation Plant. Of this 2.5 mgd, approximately 1.25 is discharged to the Los Angeles River channel, and the remainder is lost through evaporation.

animals inhabiting the cobblestone and sand invert in the river immediately adjacent to the Los Angeles-Glendale Water Reclamation Plant was made in October 1975. The vegetation growing in the river was fairly typical of an immature stream or creek in Southern California. The relatively immature nature of the vegetation is due to the periodic flooding which occurs in years of above normal precipitation. Such flooding in a channelized river could eliminate most, if not all, of the vegetation in the riverbed. After heavy flooding, normal succession could be expected to occur with the trapping of silt and organic matter until the vegetation reached a stage similar to that presently found near the LAGWRP site. Upon examination of the site, it appeared that the vegetation was as much as two or three years old. The most abundant species of plants were cattail (*Typha angustifolia*) and bulrush (*Scirpus acutus*) which grow in the actual watercourse. In places where stands of bulrush or cattail had built up, and consequently a buildup of silt had occurred, relatively less-mesophytic species had become established. These species include dock (*Rumex* sp.), cocklebur (*Xanthium strumariam*), willows (*Salix* sp.), mulefat (*Baccharis viminea*), sunflower (*Heliantrus annuus*), and giant reed (*Arnudo donax*). Additional species which grow in the actual waterway include knotweed (*Polygonus lapathifolium*) and *Ludwigia peploides*. Most of these species occur in wet-waste places and would generally be expected to colonize any disturbed wet area.

The birds observed at this site were Brewers black birds, redwinged blackbirds, and near the waters edge, two kildeer. Small minnows and fresh water snails were present. Aquatic insects were abundant, both as adults and as larval or nymphas (naiad) stages. Damselflies (Zygoptera) were especially abundant as adults. There were some adult dragonflies, and in the water, adult dytiscids (water beetles) and corixids (water boatmen) were swimming. Although none were observed, the habitat would support a range of common aquatic insects such as hydrophilids, gerrids (water striders), notonectids (back swimmers), etc. No larval mosquitoes were seen although they are known to occur in the River. Larval forms of mayflies were also present.

(2) DOWNRIVER FROM THE LOS ANGELES NARROWS—CONCRETE-LINED CHANNEL. The river is a concrete-lined channel for a distance of 39 km (24.2 miles) to Willow Street (Figures II-59 and II-60) (ESI & KKI, 1969). The width varies from 54 m (177 feet) at the Narrows to 143 m (470 feet) at Willow Street, and the respective flow capacities are 2,377 m^3/sec (84,000 cfs) and 4,132 m^3/sec (146,000 cfs).

The lined sections of the river are trapezoidal in cross section and have central low-flow sections designed to confine the water during low-flow periods (the dry season) to the center of the channel. This design feature limits the accumulation of debris, stagnant water, nuisance algae, and mosquito larvae. The low-flow section has differing capacities in various parts of the river. Tables showing depth versus discharge rate are available from the Los Angeles County Flood Control

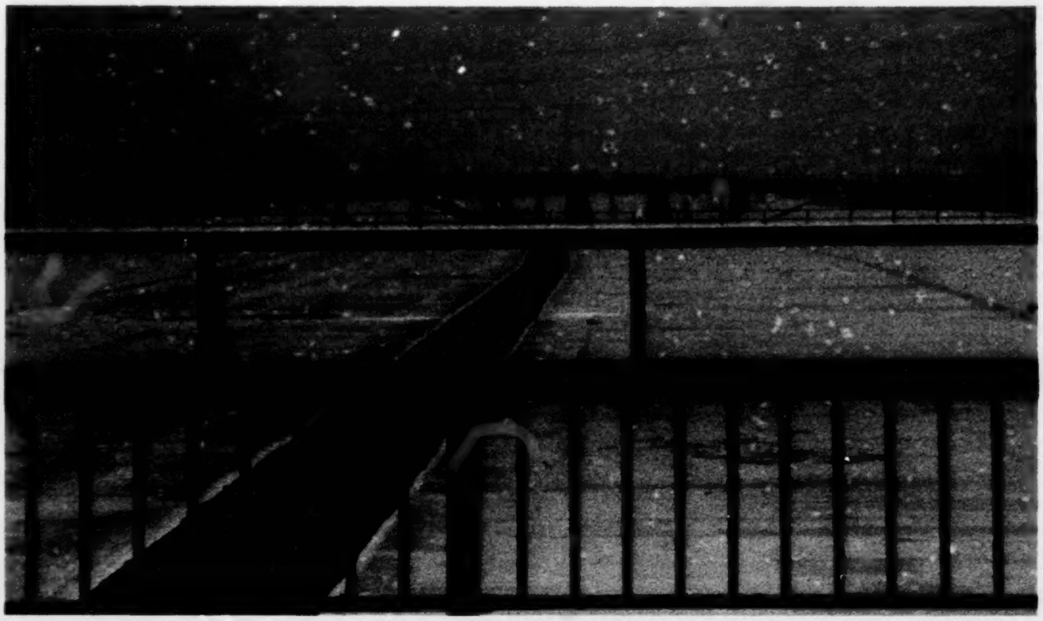

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Figure II-60. The concrete-lined channel of the Los Angeles River, looking north from Willow Street with water in the central low-flow channel, 13 May 1976. Photography: R. Thompson, HDR.

District, and have been used for several representative stations along the River to predict the frequency with which addition of treated effluent from inland sewage treatment plants (the proposed Sepulveda Facility and the existing LAGWRP) will cause water to spread out of the low-flow section. These calculations are presented graphically in Section VIII.B.

The water quality in the Los Angeles River is examined monthly using single grab samples at 14 locations (marked "S" on Figure II-59), and the data are collected by the Los Angeles County Flood Control District. Raw data sheets for the 1973-1974 season were obtained from LACFCD for three stations along the River, at Tujunga Avenue, Firestone Boulevard, and Wardlow Road. Selected data on the existing water quality are presented in Table II-19 for these locations. The data include some of the characteristics of effluent most likely to have an effect on the biological characteristics of the River. Also included are the estimated values of these variables in the effluent from the proposed Sepulveda Facility and from LAGWRP (from the NPDES permits) and the limits imposed by the State Regional Water Quality Control Board. Selected aspects of water quality between 1970 and 1975 are summarized in Table II-20 for the Pacific Coast Highway collection station within the tidal prism.

Table II-19. Water quality in the Los Angeles River at two sampling stations, anticipated water quality of the effluent from the Sepulveda Facility, and the Regional Water Quality Control Board limits for quality of water discharged to the river. The information on the Sepulveda Facility is from RWQCB Order No. 75-38 (the NPDES Permit). The information on existing water quality is from raw data sheets supplied to HDR by the Los Angeles County Flood Control District.

	PHYSICAL		NUTRIENTS (MG/)			OXYGEN (MG/L)			BACTERIA (NO/100 ML)		
	FLOW (MGD)	TEMPERATURE (°F)	AMMONIUM	NITRATE	PHOSPHATE	DISSOLVED OXYGEN	CHEMICAL OXYGEN DEMAND	BIOCHEMICAL OXYGEN DEMAND	TOTAL COLIFORM	FECAL COLIFORM	FECAL STREPTOCOCCI
Tujunga Avenue											
(Between Sepulveda and LAGWRP)											
Jan 3, 1974	18.40	39	0	15.4	0.15	10.9	-	6	48,000	920	4,200
Feb 7, 1974	18.29	40	0	16.8	0.16	10.4	11	2	5,200	220	4,200
Mar 3, 1974	527.00	57	1.8	4.5	1.7	7.7	176	< 41	56,000	2,800	> 57,200
Apr 2, 1974	175.15	59	0.41	5.9	0.9	7.3	93	34	120,000	17,800	63,600
May 7, 1974	21.55	59	0	6.9	.07	7.3	73	6	6,700	80	700
Jun 6, 1974	22.32	61	0	5.6	0.3	6.7	40	6	8,000	350	2,100
Jul 9, 1974	18.29	68	0	3.8	0.69	6.7	42	2	11,600	330	12,400
Aug 2, 1974	18.29	70	0	0	0.82	5.7	57	5	24,000	200	11,600
Sep 3, 1974	17.98	66	0	0	0.9	3.9	60	6	10,000	1,100	3,900
Oct 5, 1973	17.21	57	0	9.5	0.3	6.8	31	5	30,000	1,300	23,800
Nov 5, 1973	16.43	-	0	11.0	0.6	-	25	5	12,600	620	4,000
Dec 5, 1973	13.95	44	0	18.0	1.1	10.7	25	3	19,000	600	1,900
Mean ± S.E.	73.74 ± 22.21	56.36 ± 3.43	0.18 ± 0.16	8.12 ± 1.84	0.64 ± 0.14	7.65 ± 0.69	57.55 ± 14.53	10.08 ± 3.91	28,701 ± 10,063	2,178 ± 1,499	15,800 ± 6,581
Firestone Boulevard											
(Downstream from LAGWRP)											
Jan 3, 1974	23.87	43	30.0	26.5	2.0	8.5	-	9	72,000	6,000	36,000
Feb 7, 1974	31.00	41	0	23.0	4.8	7.1	32	15	7,800,000	3,600	7,445,000
Mar 1, 1974	220.10	59	2.8	10.0	3.4	7.1	186	55	146,000	1,800	117,000
Apr 2, 1974	437.10	61	1.4	6.8	1.3	7.3	82	25	196,000	3,800	63,600
May 7, 1974	38.75	55	0	7.0	4.5	5.5	212	57	254,000	1,200	156,000
Jun 5, 1974	32.55	65	0	15.3	4.0	5.1	2	11	111,000	6,400	75,000
Jul 9, 1974	54.25	68	0	0	3.2	5.6	39	3	47,000	1,800	62,000
Aug 8, 1974	37.20	70	0	0	2.9	3.8	56	3	18,000	440	9,400
Sep 3, 1974	27.90	69	0	0	3.4	6.4	60	7	5,000	700	900
Oct 5, 1973	27.90	63	0	17.2	3.9	5.3	41	5	70,000	4,400	88,000
Nov 5, 1973	21.39	50	0	14.0	6.0	6.2	43	22	7,800	1,300	6,000
Dec 5, 1973	31.00	46	5.00	22.0	5.5	8.1	38	13	126,000	10,000	110,000
Mean ± S.E.	81.92 ± 37.49	57.5 ± 3.12	3.24 ± 2.58	11.82 ± 2.82	3.74 ± 0.41	6.33 ± 0.41	71.91 ± 20.91	18.75 ± 5.64	737,733 ± 679,287	3,453 ± 866	680,741 ± 641,785
Sepulveda Facility											
Anticipated Effluent[1]	25.5	summer/winter 74/82	9	< 1	3	72	20	5			
RWQCB Limits (Order No. 75-38)[1]											
30-Day Average								20		200	
7-Day Average		100						30		400	

[1] NPDES Permit.

Table II-20. Water quality data for the Los Angeles River at Pacific Coast Highway, Long Beach, California.[1] Analysis in parts per million except as indicated (Williams Brothers Environmental Services, 1976).

YEAR	DATE	TIME	TEMPERATURE[2] (°C)	TURBIDITY (DEGREE)	pH	DISSOLVED OXYGEN	ALKALINITY (AS $CaCO_3$)	TOTAL SOLIDS	SUSPENDED SOLIDS	DISSOLVED SOLIDS	OIL AND GREASE	CHLORIDE	NITRATE	BACTERIA COLIFORM (MPN/ML)
1970	11 Mar	1005	14	heavy	7.8	5.9	197.0	5,729	10	5,719	1.8	4,150	20.0	500
	3 Jun	0950	19	heavy	7.9	0.3	150.2	22,064	36	22,028	4.6	12,055	13.0	2,400
	2 Sep	1030	20	moderate	7.3	0.9	165.2	25,422	42	25,380	5.0	15,025	12.0	6.2
1971	6 Jan	--	10	slight	7.0	5.0	199.0	14,322	36	14,286	0.8	6,946	20.0	62,000
	3 Mar	--	10	high	7.3	11.5	180.0	1,166	18	1,148	0.4	418.1	13.4	13,000
	2 Jun	1100	18	heavy	7.8	1.7	192.8	9,243	17	9,226	2.4	4,633.9	0.7	5,000
	1 Sep	1000	20	high	8.2	6.0	192.0	19,207	481	18,726	11.6	10,205	9.0	240
	1 Dec	0950	15	low	7.7	0.6	200.0	18,933	26	18,907	2.2	9,806	13.0	13,000
1972	1 Mar	1205	18	slight	7.4	1.8	217.6	15,180	148	15,032	8.2	5,684.3	0.0	620
	6 Jun	1030	20	--	7.7	2.0	205.0	8,371	34	8,337	0.8	3,996.9	0.0	2,100
	6 Sep	1030	26	yes	7.5	1.4	189.0	16,841	5	16,836	1.6	8,068	0.5	6.2
	6 Dec	1000	12	significant	7.1	6.7	125.0	722	42	680	0.2	3,605	7.1	13,000
1973	4 Apr	0945	15	none	8.4	7.0	172.0	10,305	14	10,291	0.0	4,628.4	6.1	0.043
	6 Jun	1115	24	high	7.2	2.7	160.4	26,494	39	26,455	3.0	13,148	1.33	24
	5 Sep	1000	21	yes	8.0	0.9	214.1	9,016	13	9,006	1.6	4,710	5.3	19,000
	5 Dec	1030	13	none	7.1	1.7	162.8	15,306	11	15,295	0.6	8,078	6.6	240
1974	6 Mar	0945	14	high	7.3	2.3	165.0	19,497	8	19,489	2.4	9,844	1.3	62,000
	5 Jun	1000	20	none	7.5	0.5	58.6	28,520	82	24,438	2.2	14,742	1.1	5
	4 Sep	0930	22	turbid	7.8	1.4	136.0	30,195	25	30,170	7.6	16,822	1.4	6.2
	11 Dec	1050	15	marked	7.0	1.8	153.2	24,317	40	24,277	6.6	13,085.6	0.0	6,200
1975	2 Apr	1015	16	marked	8.4	3.1	188.5	13,763	8	13,755	2.2	8,264	5.8	240
	7 May	1035	19	marked	8.4	6.7	170.5	15,875	12	15,863	1.0	8,484	13.2	620

[1] Modified from California Regional Water Quality Board—Los Angeles Region, 1970-1975.

[2] Temperature converted from Fahrenheit to Centigrade.

Algae grows on all the wetted portions of the channel, and small matts of floating algae are often present. Phytoplankton, zooplankton, and invertebrates (such as insect larvae) are present. Most of the plankton originates from the upstream unlined section while the invertebrates may be seasonal residents or transients washed in from upstream or from storm drains.

(3) ESTUARINE ZONE. From Willow Street to the Long Beach Harbor (Figures II-61 through II-65) the channel has riprap banks and a sediment and rock bottom. Sea water enters, forming an estuarine zone (area of reduced salinity). In May 1976 Henningson, Durham & Richardson conducted a study of the estuarine zone. The depth profile and salinity gradients (at high and low tide) are shown in Figure II-66. The depth is quite irregular as a result of sandbars and rock piles. The freshwater from the river floats on top of the salinity wedge to a depth of 0.3 to 0.5 m (1 to 1.5 ft) until it becomes mixed with the subsurface water 1.6 to 2.4 km (1 to 1.5 miles) downstream. The surface temperatures showed afternoon warming in May 1976 with little change in subsurface temperatures in the area of the salinity wedge (Figure II-67). The water temperature remained relatively constant throughout the day in the mixed areas at more than 2,438 m (8,000 ft) below the Willow Street bridge. The dissolved oxygen (DO) showed a large diel variation, particularly in the lower salinity water (Figure II-67) and decreased downstream as the salinity increased. The diel variation is a function of algal photosynthesis, which increases the DO during the daylight hours, and organism respiration, which reduces it at night. Where the lined channel ends, the water spreads out and is turbulent so that physical aeration also helps to keep the DO high. The pH remained at 8.6 for about 3,050 m (10,000 ft) downstream, and then dropped to 8.1 as the water became more saline.

(a) Vegetation. In May 1976 a band of low-growing vegetation interspersed with an occasional willow (*Salix* sp.) and water wally shrub (*Bacchaus glutinosa*) extended throughout the channel bottom wherever sufficient substrate existed. The substrate was formed by the deposition of sand and silt from the river and from debris dumped into the riverbed. Periodic fluctuations in river flow result in repeated disturbance to the vegetation and substrate.

The herbaceous vegetation was dominated by naturalized weedy species (introduced to the area) which are characteristic of disturbed soils such as plantain (*Plantago imajor, P. lanceolata*) and wild radish (*Raphanus* sp.). Two native species, western ragweed (*Ambrosia psilotachya*), a common weed, and mugwort (*Artemesia darglasiana*), which is adapted to unstable moist habitats, were collected as well as garden escapes such as broccoli (*Brassica oleraceae*) and sweet alyssum (*Lohilaria maritima*).

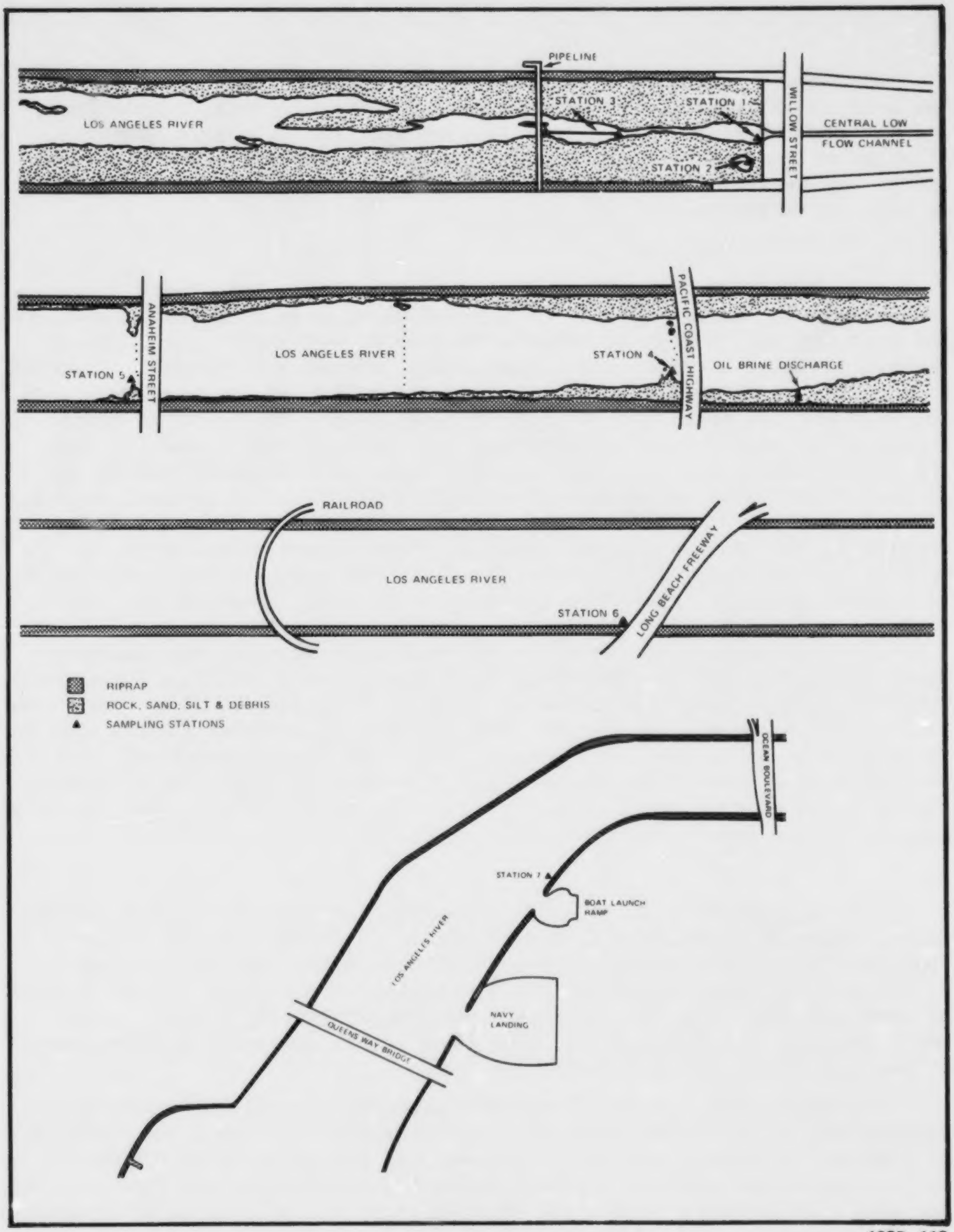
PIPELINE
STATION 3
STATION 1
LOS ANGELES RIVER
WILLOW STREET
CENTRAL LOW FLOW CHANNEL
STATION 2
ANAHEIM STREET
PACIFIC COAST HIGHWAY
LOS ANGELES RIVER
STATION 4
STATION 5
OIL BRINE DISCHARGE
RAILROAD
LOS ANGELES RIVER
LONG BEACH FREEWAY
STATION 6
RIPRAP
ROCK, SAND, SILT & DEBRIS
SAMPLING STATIONS
OCEAN BOULEVARD
STATION 7
BOAT LAUNCH RAMP
LOS ANGELES RIVER
QUEENS WAY BRIDGE
NAVY LANDING

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Figure II-61. Estuarine zone of the Los Angeles River. The numbered stations (except station 2, a stagnant pool), were sampled for salinity, DO, conductivity, temperature, and pH in May 1976. Phytoplankton, zooplankton, and benthos were also sampled. Source: Henningson, Durham & Richardson, Inc.

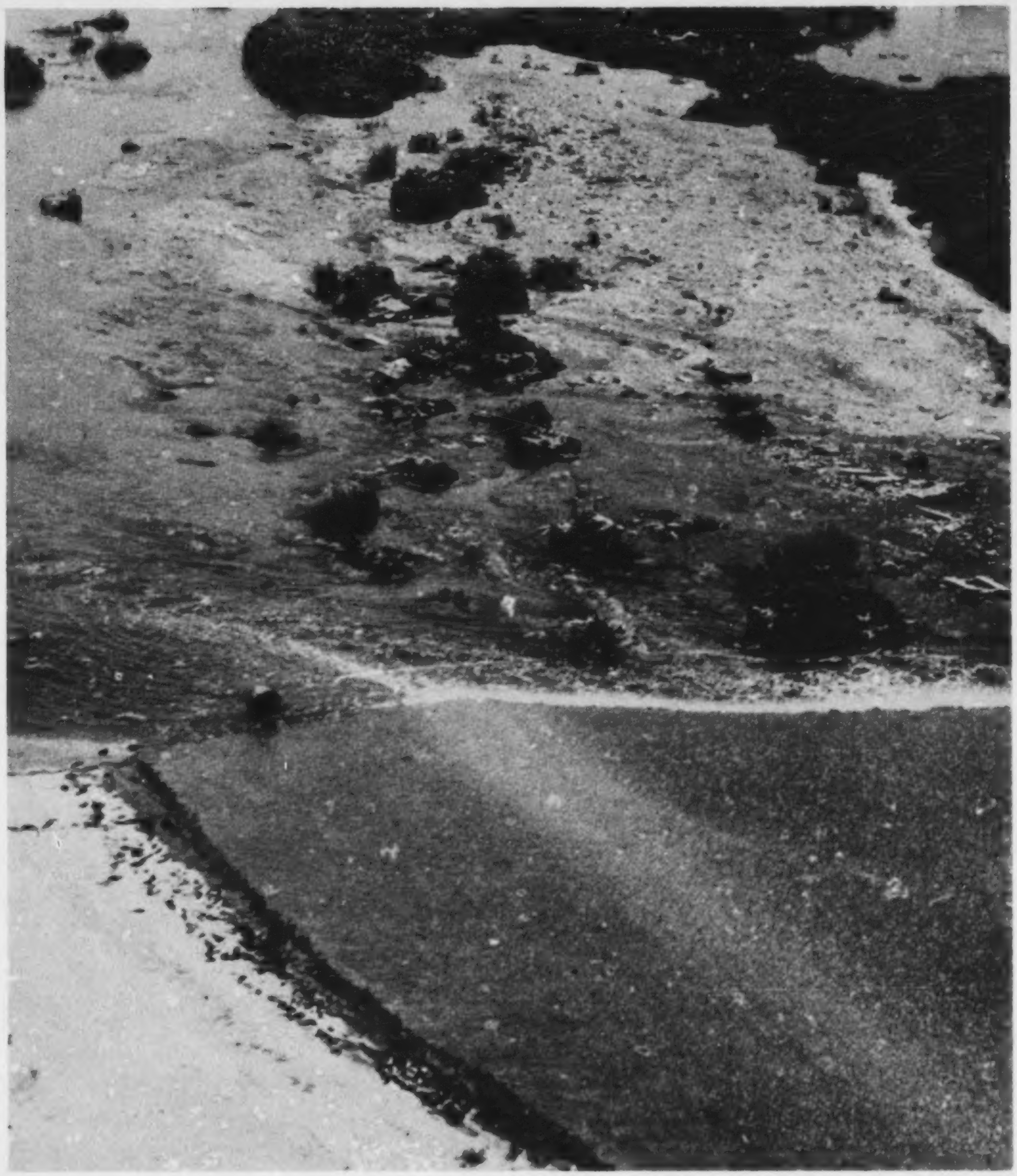

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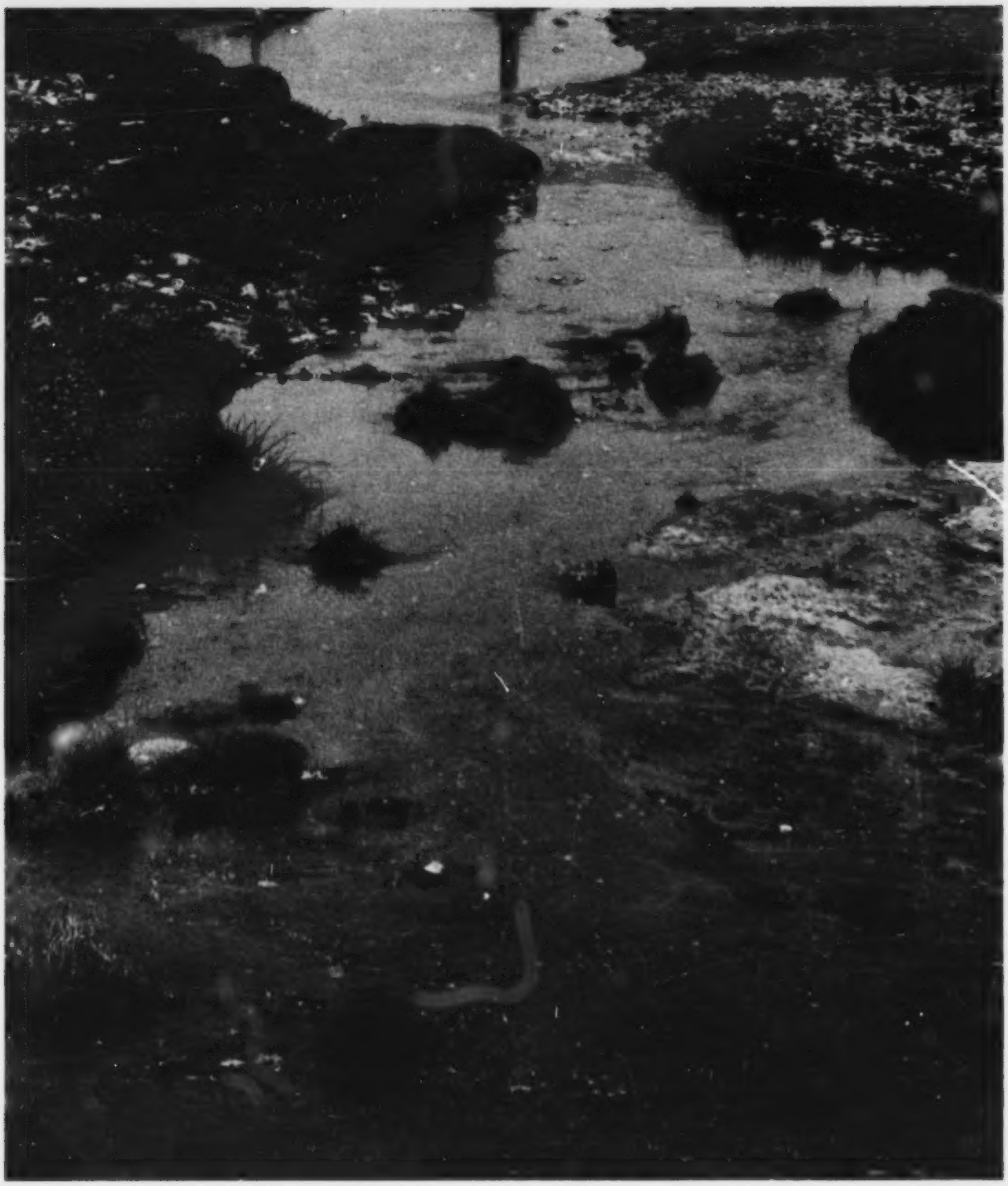
Figure II-62. The end of the concrete-lined Los Angeles River channel just below Willow Street, 13 May 1976. Photography: R. Thompson, HDR.



198P-121

Figure II-63. The unlined portion of the Los Angeles River as viewed from Willow Street. Much terrestrial vegetation and debris are present. The nearest trestle is a pipeline (13 May 1976). Photography: R. Thompson, HDR.

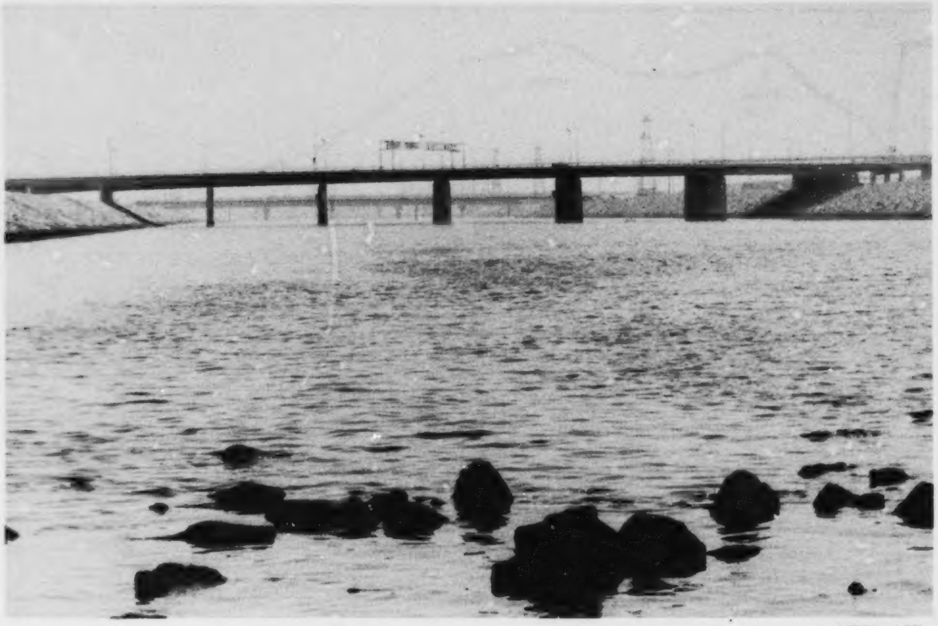


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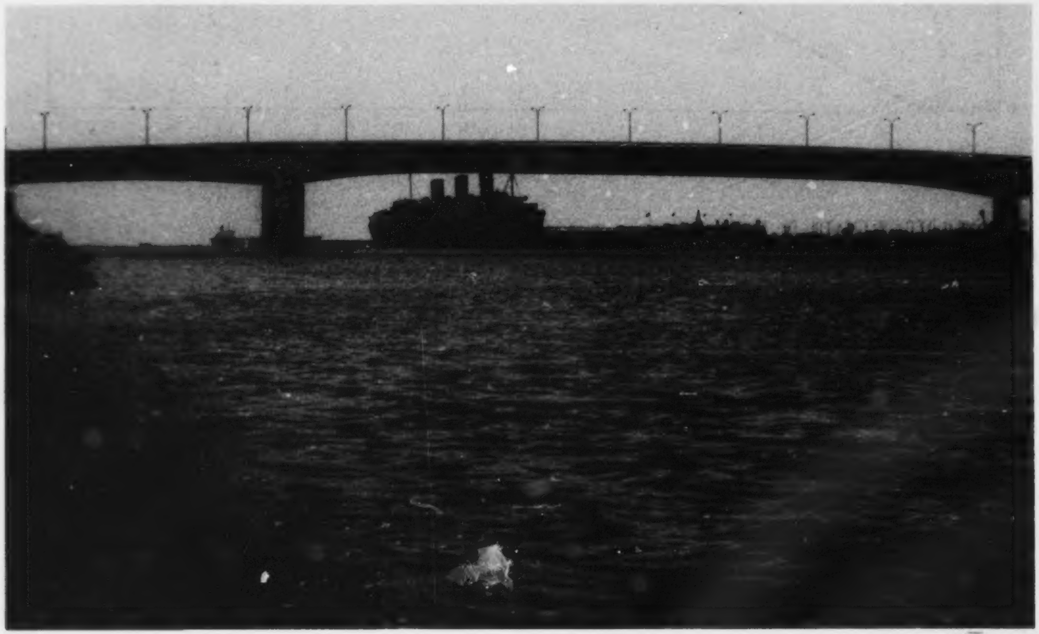
Figure II-64. The Los Angeles River looking south from Anaheim Street, 13 May 1976. The rocks in the foreground are covered with green algae and barnacles. Photography: R. Thompson, HDR.



198P–123

Figure II-65. The Los Angeles River looking south from Station 7 (just upstream from the boat-launching ramp). The Queen Mary is in the background (19 May 1976). Photography: R. Thompson, HDR.

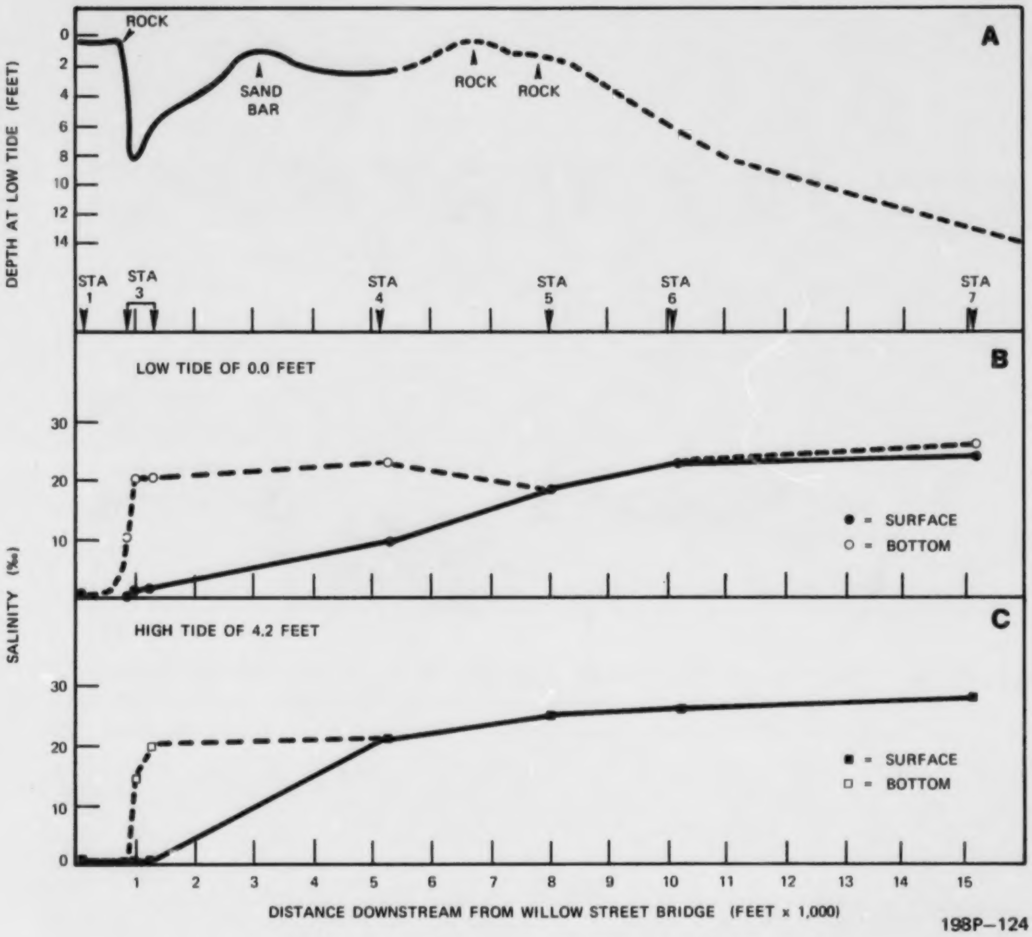


Figure II-66. Los Angeles River Estuarine Zone, 19 May 1976.

A. Bottom profile of the Los Angeles River from Willow Street to the Long Beach Harbor. The depths downstream to Station 4 were measured at a low tide of 0.0 feet while the other depths were estimated (dashed line).

B. Surface (closed symbols) and bottom (open symbols) salinity measured at low tide (0.0 feet).

C. Surface (closed symbols) and bottom (open symbols) salinity measured at high tide (+4.2 feet).

Source: Henningson, Durham & Richardson.

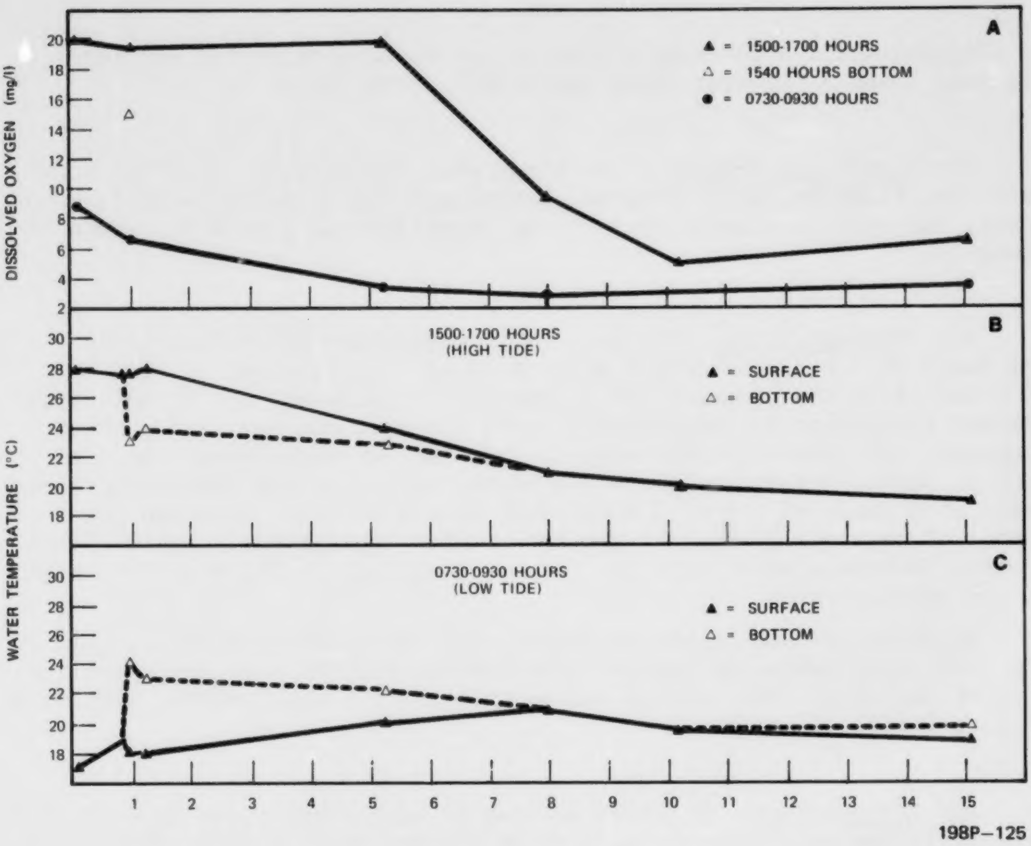


Figure II-67. Los Angeles River Estuarine Zone, 19 May 1976.

A. Surface (closed symbols) and bottom (open symbols) dissolved oxygen in the morning (circles) and afternoon (triangles).

B. Surface (closed symbols) and bottom (open symbols) water temperatures taken at high tide (+4.2 feet) and low tide (0.0 feet).

C. Surface (closed symbols) and bottom (open symbols) water temperatures taken at high tide (+4.2 feet) and low tide (0.0 feet).

Source: Henningson, Durham & Richardson.

Appendix III.B contains a list of the species collected between stations 1 and 3 (Figures II-61 and II-63) in May 1976.

(b) Birds and Mammals. The birds observed at these stations were swallows, killdeer, house finches, mourning doves, blackbirds, gulls, and terns. An aquatic mammal, tentatively identified as a muskrat, was also observed.

(c) Phytoplankton. The density of phytoplankton (Figure II-68 and Table II-21) ranged from a high of 52,356 organisms/ml at station 5 to a low of 10,254 organisms/ml at station 3 (surface), and 10,988 organisms/ml at station 1. Pyrrhophytes were the most abundant group at all stations. Diatoms were less abundant but just as widespread. At station 3, phytoplankton abundance was higher in the more saline subsurface water at a depth of 0.6 m (2 feet) than at the surface, although the number of taxa was similar in the two samples (see Appendix III.B). The surface abundance was similar to that at station 1, reflecting the origin of the surface water.

At least 20 taxa of phytoplankton were collected from all stations combined. The number of taxa at each station did not show any relationship to salinity. The highest number of taxa, 12, was found at station 4 (Figure II-69).

(d) Zooplankton. At least 16 taxa of zooplankton (see Appendix III-B) were collected in the estuarine zone of the Los Angeles River using a small (10 cm diameter, 76 µ mesh) net towed for a short distance (18 to 23 meters) at stations 3 through 7. Density ranged from a high of 9,402 organisms/m^3 at station 7 to a low of 347/m^3 at station 3 (Table II-22 and Figure II-68). The number of taxa also decreased from Long Beach Harbor upstream (Figure II-69) with 12 taxa being collected at station 7, 5 taxa at station 3, and 3 taxa at station 4. Copepods and polychaete larvae were the most abundant zooplankton at the more saline stations, whereas chironomids were most common at station 3. Ostracods and barnacle nauplii were the most prevalent organisms at all stations, occurring at 4 out of the 5 stations sampled.

(e) Benthos. Epibenthic organisms and infauna were sampled at the six stations shown in Figure II-61 (station 2, stagnant pool, was not sampled), and the taxa collected are presented in Appendix III.B. The number of taxa observed increased with distance downstream (increasing salinity) as shown in Figure II-69. Station 1 is freshwater and station 7 is marine, with stations 3-6 intermediate. Freshwater green algae was growing attached to solid substrates at stations 1, 3, 4, and 5, while marine species (mainly *Ulva*) were found at stations 5 through 7. Clumps of

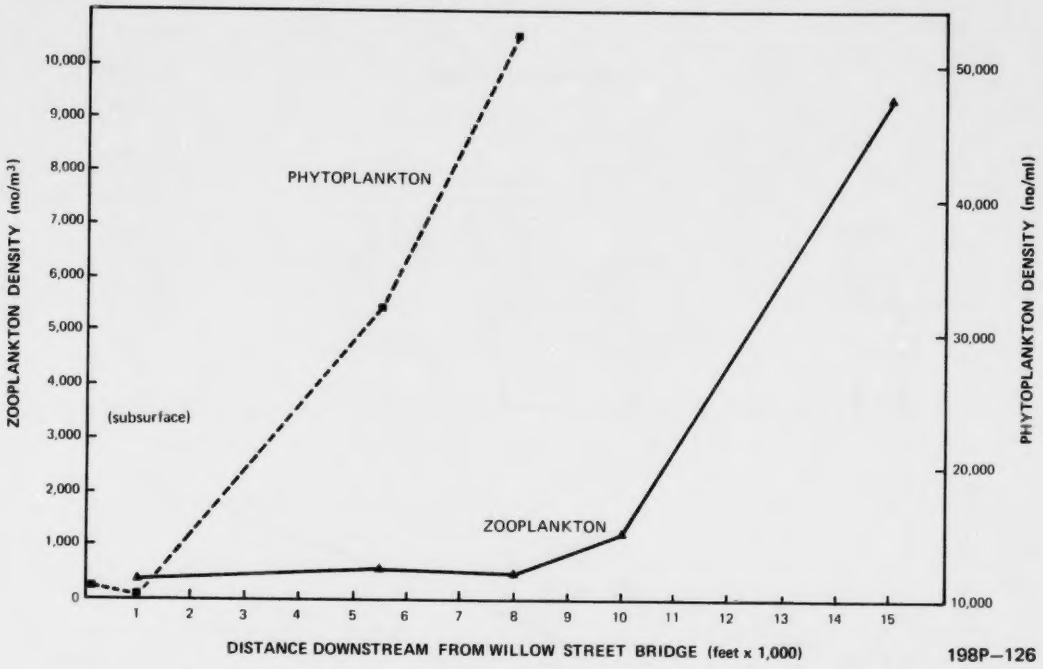


Figure II-68. Densities of phytoplankton and zooplankton in the Los Angeles River estuarine zone in May 1976.

Source: Henningson, Durham & Richardson.

Table II-21. Density (number/ml) of phytoplankton collected by HDR in whole water samples at stations in the estuarine zone of the Los Angeles River on 13 May 1976 (see Figure II-61) for station locations.

TAXA	STATION				
	1	3 (2' DEPTH)	3 (SURFACE)	4	5
Large Dinoflagellates		6,593	366	8,420	25,600
Small Dinoflagellates	5,861	9,524	6,590	16,120	19,800
Pennate Diatoms		1,832	1,832	1,830	2,930
Centric Diatoms	366			733	
Blue-Green Filamentous				1,470	1,100
Euglenoid Algae		366	366	366	366
Colonial Green Algae	366			1,470	
Filamentous Green Algae		1,100			
Unicellular Green Algae	4,029	366			
Misc. Unknown Algae	366	1,465	1,100	1,470	2,560
TOTAL	10,988	21,246	10,254	31,879	52,356

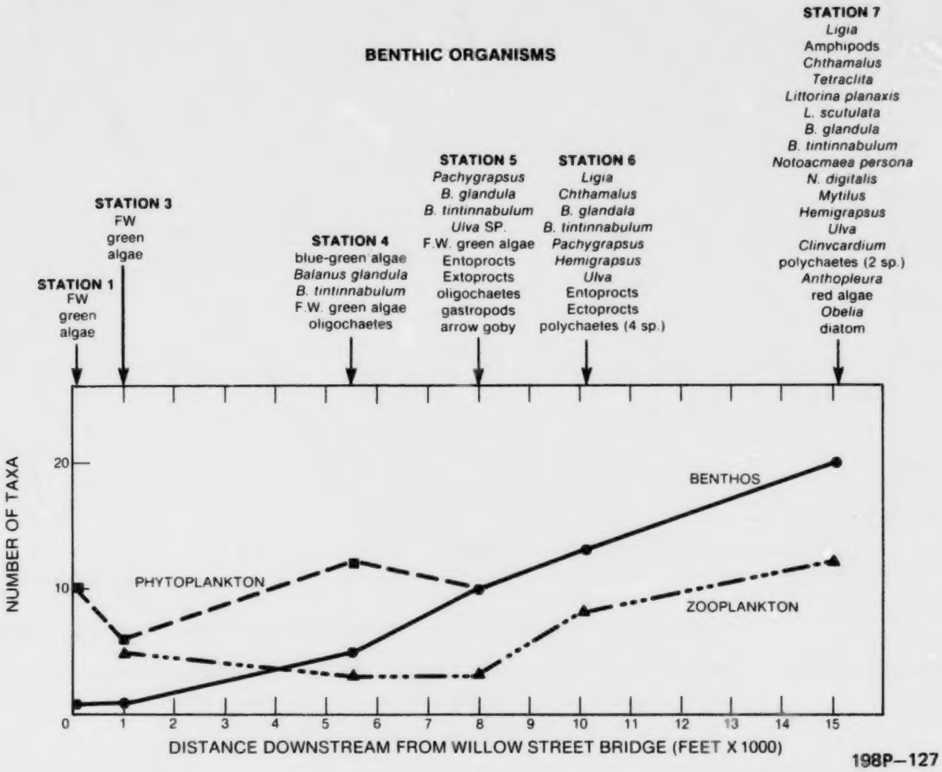


Figure II-69. Number of phytoplankton, zooplankton, and benthos taxa collected or observed at six sampling stations in the estuarine zone of the Los Angeles River in May 1976. The vertical order represents the approximate vertical zonation of benthos observed.

Source: Henningson, Durham & Richardson.

Table II-22. Density (number/m^3) of zooplankton collected at various stations along the Los Angeles River on 19 May 1976 using a 10 cm diameter net (76 μ mesh) towed 18 to 23 m at each station.

TAXA	STATION				
	3	4	5	6	7
Polychaete larvae			81	80	1,504
Copepods				828	6,319
Copepod nauplii		113			
Ostracoda		340	162	80	752
Cladocerans					75
Barnacle nauplii		113	243	226	376
Nematodes					75
Rotifers	139				
Chironomids	208				
Miscellaneous					301
TOTAL	347	566	486	1,204	9,402

freshwater green algae (2 species) were also floating at stations 6 and 7 but not at any of the other stations; however, hydrogen sulfied odor was present in the sediments at stations 3 and 4 which indicates anaerobic conditions hostile to most organisms.

The density of epibenthic organisms increased with distance downstream. Barnacles and green algae encrusted the rocks at station 4 with approximately 25 barnacles/100 cm^2. The barnacles were all large adults, many of them dead. At station 5 the barnacle density increased to approximately 60/100 cm^2, and the green algae was much denser than at station 4. The barnacle density at station 6 was similar to that at station 5 and many newly settled barnacles were observed. At station 7 vertical zonation was very pronounced. In the upper zone *Chthamalus* (a small barnacle) occurred in densities of about 100/100 cm^2. *Balanus* spp. dominated the middle zone and mussels the lower zone. The densities for both of these zones were approximately 50 organisms/100 cm^2, which represents almost complete coverage of the available substrate. Many newly settled barnacles were present on the rocks and on the outside of the mussels. The green algae was quite dense in the lower zone, and a few clumps of red algae were present.

Juvenile fish were collected at station 5 and larval fish were taken in the zooplankton samples at station 6 and 7. Several species of fish may occur in the more saline areas of the estuary where other factors, such as DO, are not limiting. Those expected are white croaker, surf perches, opaleye, and bogies, with occasional occurrences of atherinids (smelt) and anchovies (Fitch, 27 May 1976).

f. Ballona Creek. Ballona Creek is a channelized watercourse some parts of which are lined with concrete rubble and most of which has a mud bottom. The location is shown on Figure II-59. Figure II-70 shows the creek bed in July 1976 looking west from the Centinela Avenue overcrossing near the Sawtelle Boulevard sampling and gauging station. Discharge rates in the creek are highly variable with daily discharges at Sawtelle Boulevard ranging from 18.4 to 482 mgd in 1974 (LACFCD 1973-1974 hydrologic report). The mixing zone (estuarine zone) extends from the mouth of the creek adjacent to the outlet of Marina del Rey, upstream to Centinela Avenue from which Figure II-70 was taken. There have been no recent detailed biological surveys of the estuarine zone.

The wetlands adjacent to the creek to the south (see Figure II-59 for location, Figure II-71 for a photograph) are connected to the creek by flap gates which occasionally become clogged with barnacles, and allow water from the creek into the wetlands. The normal flow pattern, however, is for surface runoff and rainfall entering the wetlands to flow into the creek.

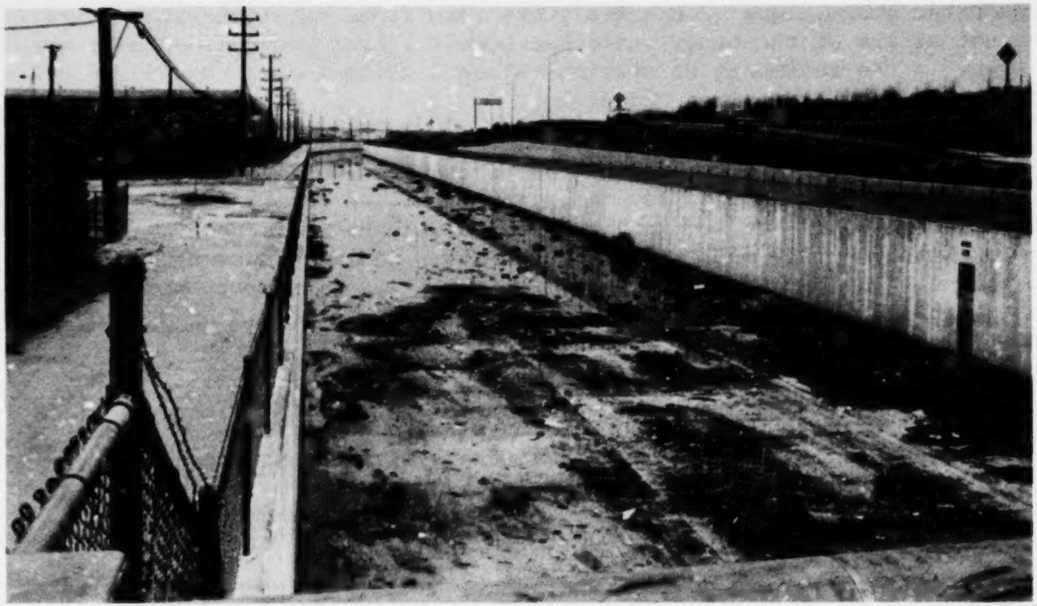


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Figure II-70. Ballona Creek looking west from the Centinela Avenue overcrossing.

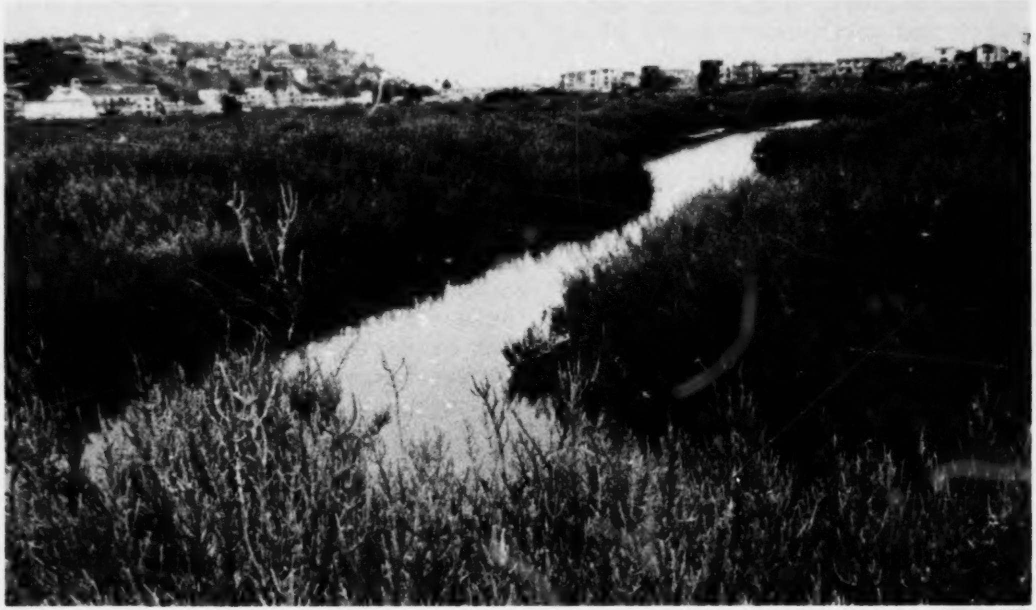

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Figure II-71. View to the west toward the Pacific Ocean and Playa del Rey from the wetlands adjacent to the south side of Ballona Creek. Photograph taken in July 1976.

E. the socioeconomic environment

II-167

E. THE SOCIOECONOMIC ENVIRONMENT

1. LAND USE PATTERNS

The City sewage treatment facilities at Hyperion, Terminal Island, and Los Angeles-Glendale rely upon the extensive sewer system noted in Chapter I and described in Chapter VI to provide wastewater treatment service for the diverse residential, commercial, industrial, and institutional activities throughout the City of Los Angeles. However, the area influenced by the City of Los Angeles extends beyond the wastewater treatment Service Area. This chapter will consider the social and economic characteristics of the City, with reference to regional activities as necessary, to compare such aspects as employment and commuting patterns both in and out of the City. These data will provide a basis for secondary impact analysis, Chapter IX, and provide a reference point for evluation of treatment alternatives, Chapter VII.

The City of Los Angeles has a broad area of influence. A circle with a 60-mile radius centered on Los Angeles City Hall would traverse an arc from the agricultural Oxnard plain across the rugged Angeles National Forest, around the cities of San Bernardino and Riverside, and end on the Pacific Coast near San Clemente. This 60-mile radius would include within it less than 5 percent of the land area of California and nearly 47.5 percent of the population of this, the most populous state in the Union. The City of Los Angeles, with 2.76 million residents, is the nation's third largest city and contains approximately one-third of the total population circumscribed by the 60-mile circle. The city itself contains samples of nearly all of Southern California's varied resources.

The City of Los Angeles is characterized by low density development over the majority of its 469 square miles. Major residential emphasis has been upon the single family detached dwelling although, more recently, multiple family dwellings have developed along major boulevards and freeways. Recreational opportunities are varied with mountains and seashore both within easy commuting distance.

The recreational emphasis is upon large multiple use open spaces such as the Sepulveda and Hansen Flood Control Basins and the nearly seven square mile Griffith Park Area. The developed area of Griffith Park, nearly 3 square miles, is the largest municipal recreational area in the nation, and the park has the distinction of being one of the few City Parks in which forest fires can and do occur.

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As the financial, commercial, industrial, and tourist center of Southern California, Los Angeles offers diverse employment opportunities. Commercial activity is centered just west of the downtown area although additional commercial enterprises are located in the Wilshire Corridor, along Santa Monica Boulevard, and adjacent to major streets throughout the city. Industry is concentrated in the harbor, along the Los Angeles River in the eastern portion of the city and along the Southern Pacific Railroad lines that traverse the northeastern and central sections of the San Fernando Valley.

The different land usages are clearly visible in Figure II-72, Existing Land Use in Los Angeles City. The concentration of red in downtown shows the existing commercial activity that stretches out to the west along Wilshire Boulevard. Commercial activity along all the major thoroughfares, called "strip commercial," can clearly be seen both in the downtown area and in the San Fernando Valley. Four streets that are nearly solidly strip commercial are Ventura Boulevard that forms the southern border of the San Fernando Valley, Van Nuys and Sepulveda Boulevards that trend north and south in the center of the Valley, and Lankershim Boulevard that parallels the Hollywood Freeway on the eastern end of the Valley.

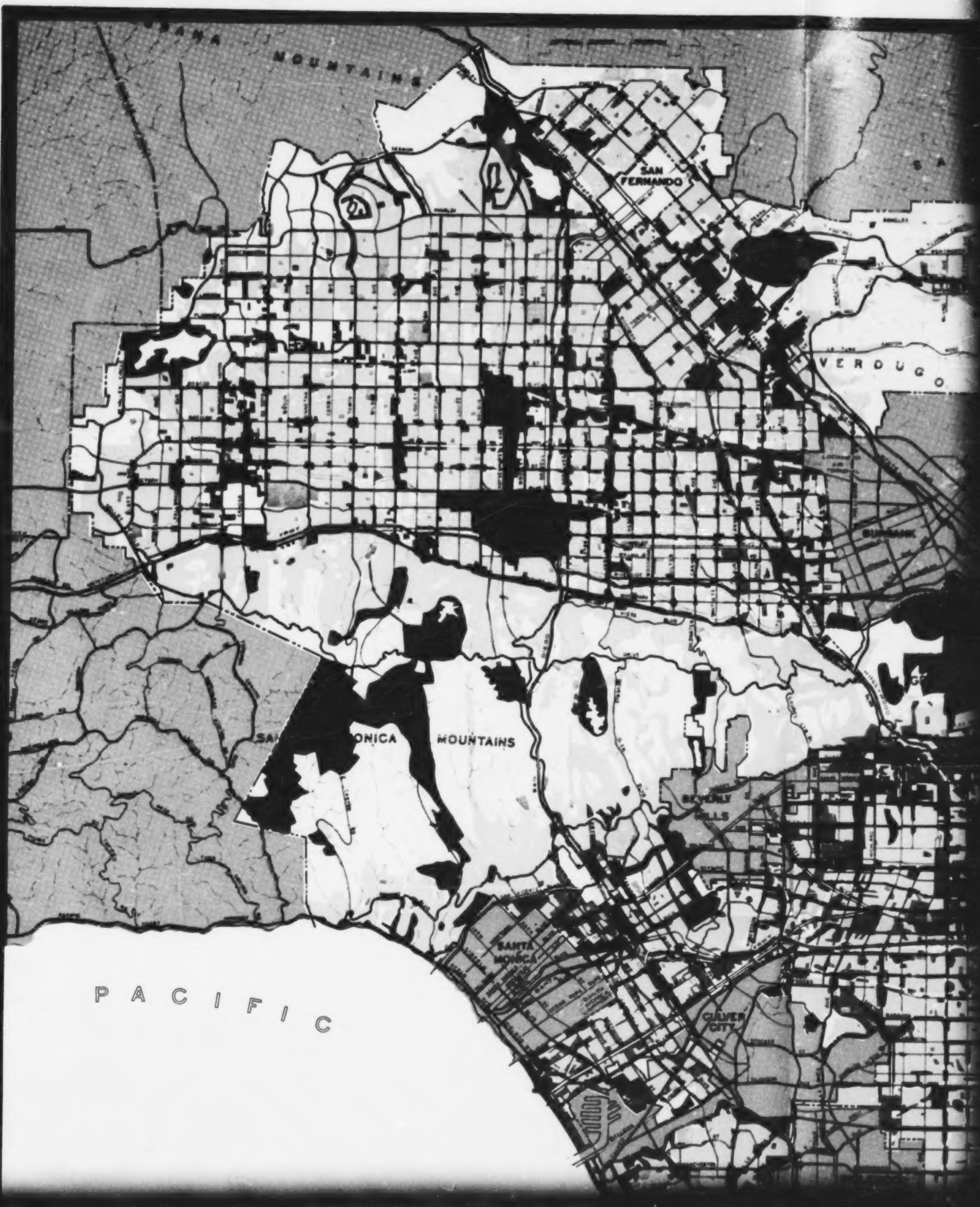
Strip commercial represents the predominant type of commercial zoning in the city with over 550 miles of frontage by 1974. Urban activity in the San Fernando Valley has resulted in a number of shopping centers generally located at the intersections of primary streets and spaced at 1-mile intervals. Western and Topanga Canyon Boulevards in the western end of the Valley have more concentrated shopping areas, including malls that encourage consumers to park their cars and shop for several items rather than a separate trip for each shopping item.

Employment centers include industrial activity, in blue, on Figure II-72. Industrial development was shaped by the growth of two major transportation systems: Southern Pacific Railroad and the shipping trade. As a result, areas of industrial activity outside of the central business district have agglomerated near the harbor and along railway corridors. Industrial development along these rail alignments is distinguishable in the San Fernando Valley by the long blue line traveling northwest out of downtown, which splits in the City of Burbank to become two routes. One of these travels northwest towards and through the City of San Fernando, while the other travels west across the Valley.

Further concentrations of Valley industrial development are located north and south on Canoga Avenue in the West Valley and to the east of Sepulveda Boulevard in the South Central Valley. This industry is also constructed along old railway spurs that connect these areas with the Southern Pacific mainlines. The railway system that predated the freeways by five decades shaped the industrial development of the San Fernando Valley (Figure II-73).

Surveying patterns of development in 1967, the City of Los Angeles Planning Department identified major trends that were expected to continue into the future:

A


SANA MOUNTAINS
SAN FERNANDO
SA
VERDUGO
BURBANK
SANTA MONICA MOUNTAINS
BEVERLY HILLS
SANTA MONICA
CULVER CITY
PACIFIC

B

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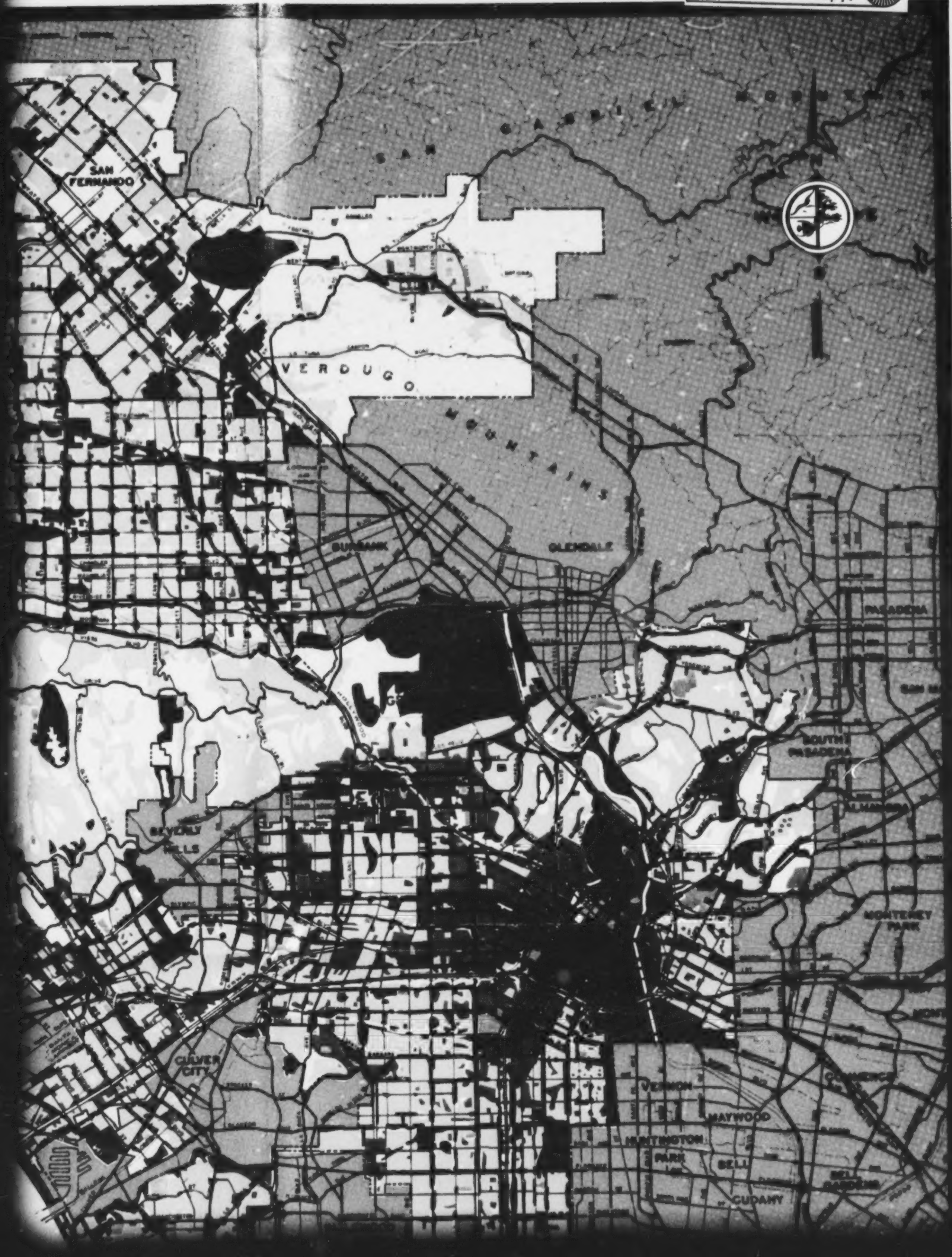
SAN GABRIEL MOUNTAINS
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VERDUGO MOUNTAINS
BURBANK
GLENDALE
PASADENA
SOUTH PASADENA
BEVERLY HILLS
MONTEREY PARK
CULVER CITY
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY

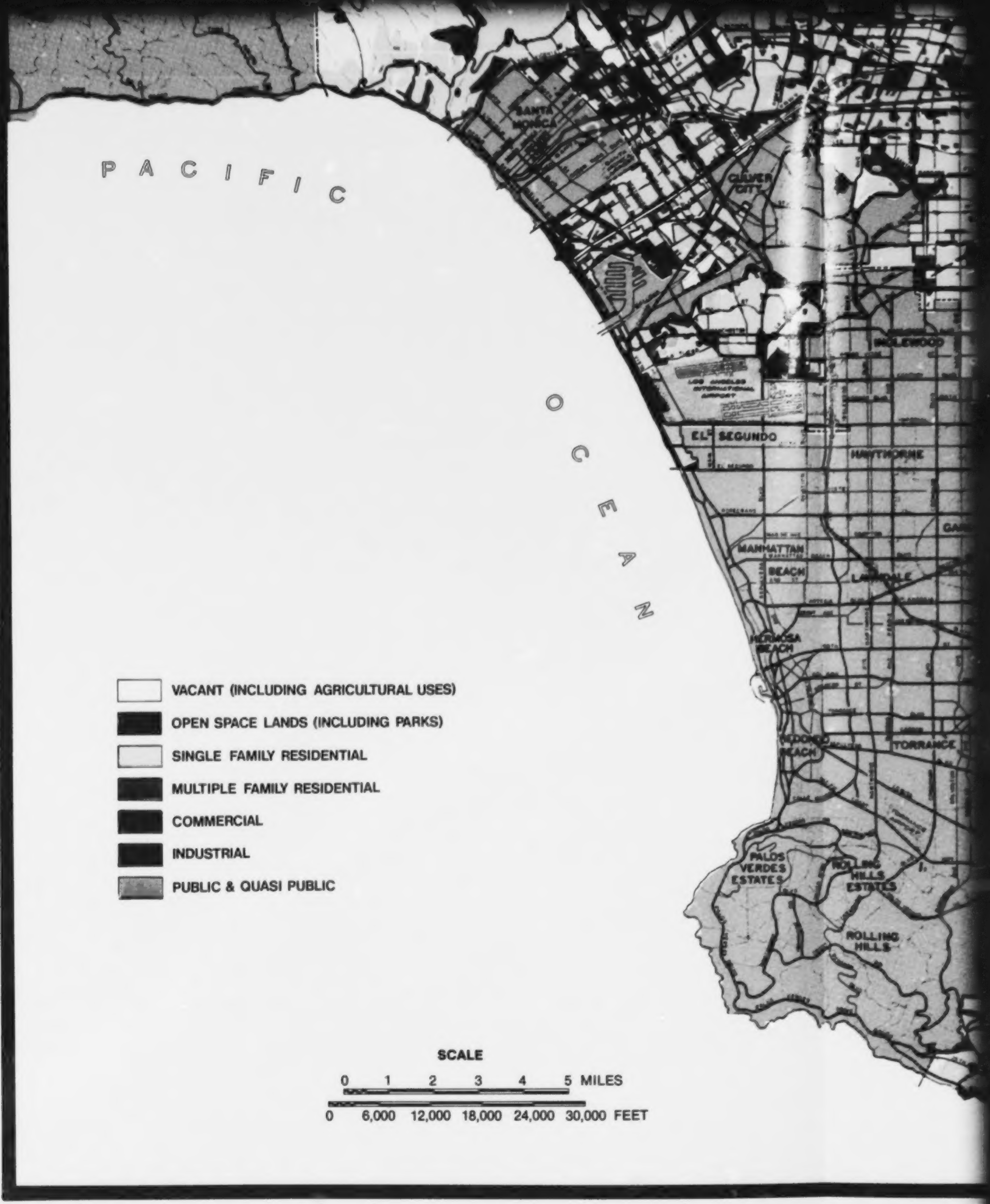
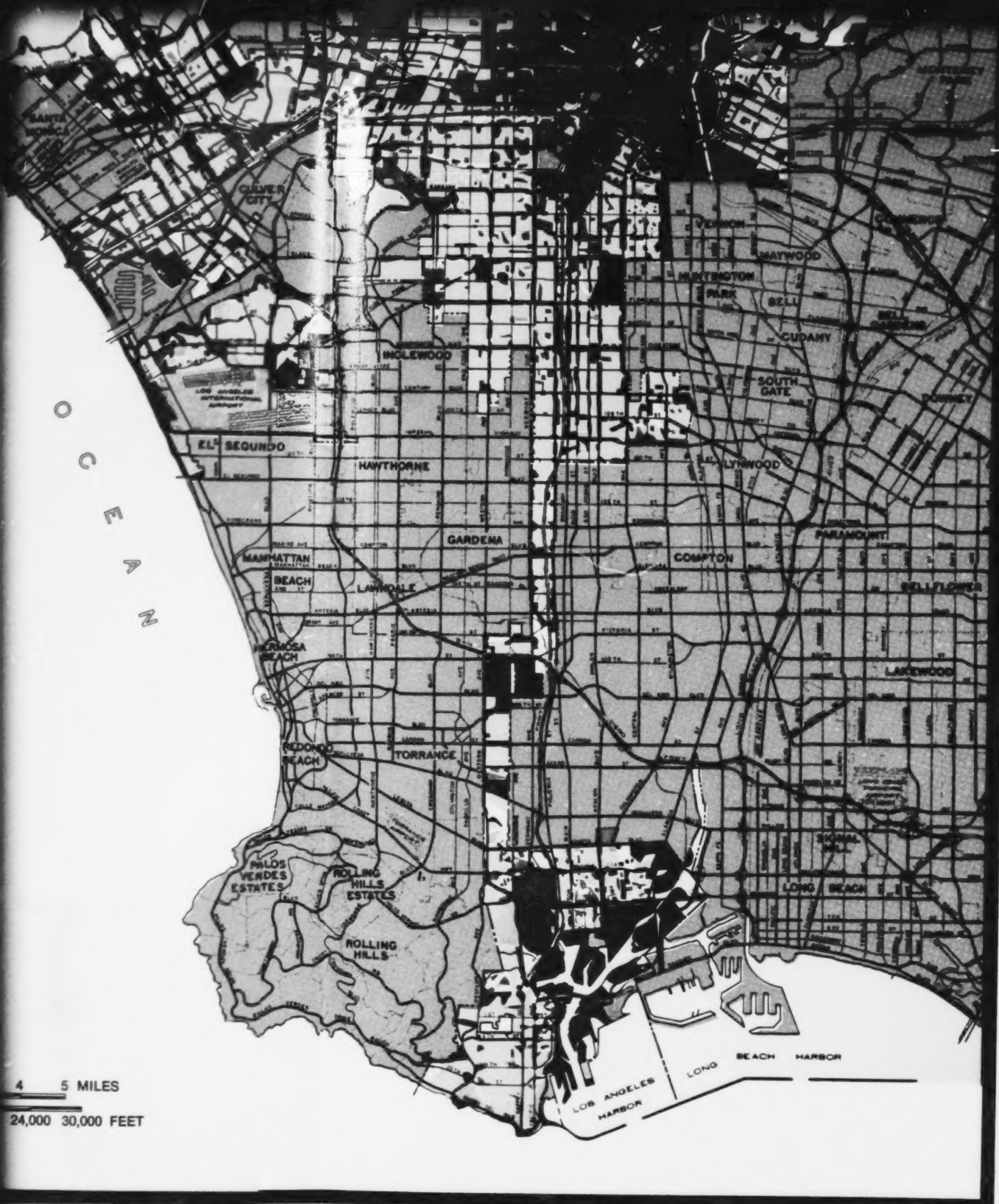

PACIFIC
OCEAN
SANTA MONICA
CULVER CITY
INGLEWOOD
LOS ANGELES INTERNATIONAL AIRPORT
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
VACANT (INCLUDING AGRICULTURAL USES)
OPEN SPACE LANDS (INCLUDING PARKS)
SINGLE FAMILY RESIDENTIAL
MULTIPLE FAMILY RESIDENTIAL
COMMERCIAL
INDUSTRIAL
PUBLIC & QUASI PUBLIC
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET

Figure II-72. 1974 existing land use for the City of Los Angeles.

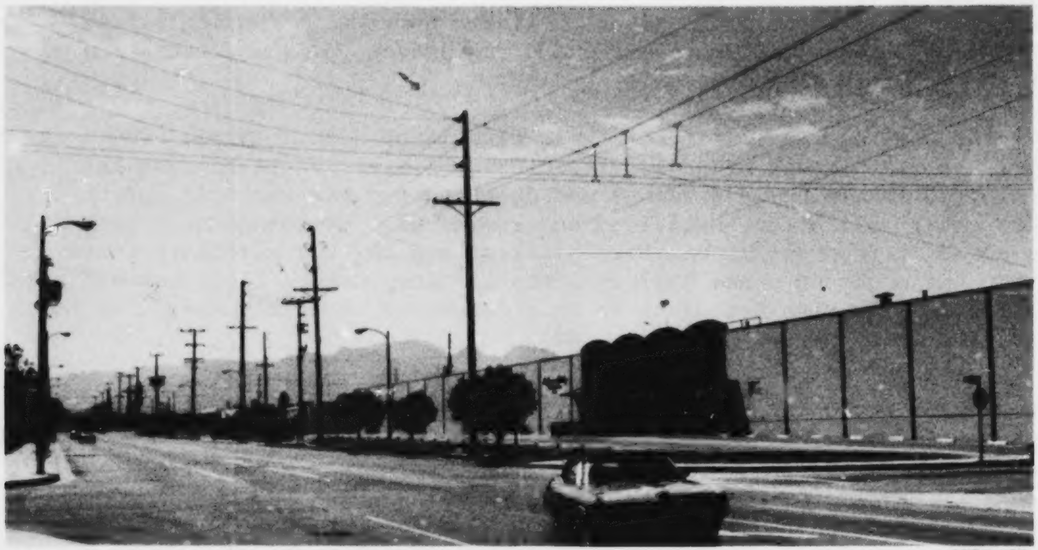
C


SANTA MONICA
CULVER CITY
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY
INGLEWOOD
LOS ANGELES INTERNATIONAL AIRPORT
SOUTH GATE
DOWNEY
EL SEGUNDO
HAWTHORNE
LYNWOOD
OCEAN
GARDENA
PARAMOUNT
MANHATTAN BEACH
COMPTON
LAWNDALE
BELLFLOWER
HERMOSA BEACH
LAKEWOOD
REDONDO BEACH
TORRANCE
SIGNAL HILL
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
LONG BEACH
ROLLING HILLS
LONG BEACH HARBOR
LOS ANGELES HARBOR
4 5 MILES
24,000 30,000 FEET

198P-34

Los Angeles.

D



198P-133

Figure II-73. Medium and light industry in the San Fernando Valley began around the existing railway transportation system. Manufacturers use both rail and truck to export products although newer developments such as this one in the northwest section of the Valley do not have nearby access to freeways.

1) Vacant land would continue to be subdivided for single-family homes;
2) Older single-family homes would be replaced by apartments with minimal open space;
3) Little or no low-cost housing would be built;
4) Industry would remain in outlying areas;
5) Offices and specialized services would remain primarily in several central locations;
6) New retail commerce would locate in shopping centers at the expense of old commercial strips;
7) Offices would continue to concentrate along Wilshire Boulevard and at Los Angeles International Airport;
8) Jobs in large-scale industries would continue to be separate from residences;
9) Congestion and vehicle storage would continue to be a problem;
10) Public transit would continue to be provided at minimal levels;

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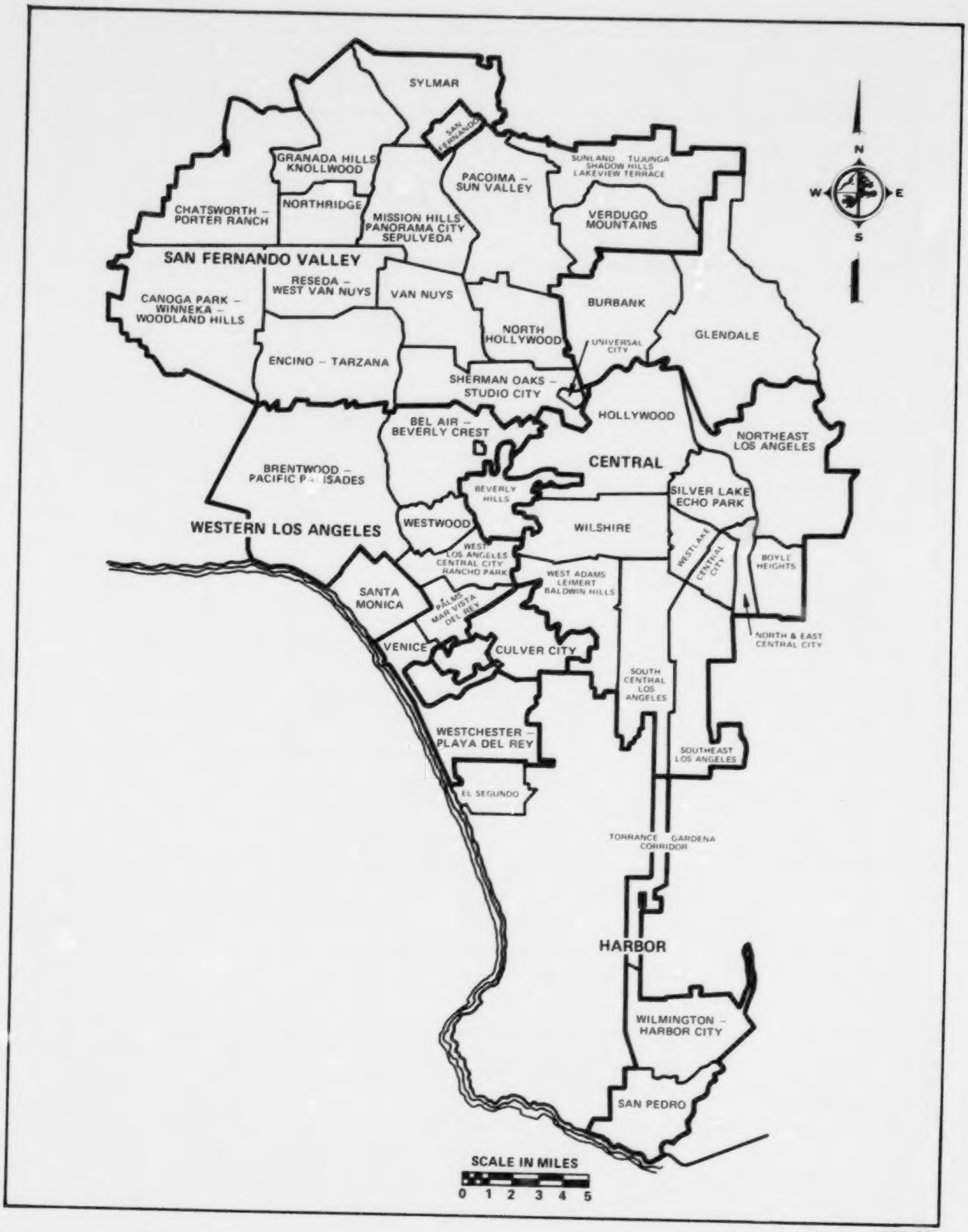
11) Open space would be primarily in back yards (Environmental Science and Engineering and the School of Architecture and Urban Planning, 1975).

Recent modification of these trends associated with economic growth and the near attainment of physical expansion limits in Los Angeles has resulted in rising land values and encouraged a new vertical aspect to the city; tall office buildings and residential buildings have been erected in the central business district and in many auxiliary centers. This has occurred since 1957 when the 13-story height limit was abolished allowing high-rise buildings to be constructed in earthquake-prone Los Angeles (City of Los Angeles, 1974).

The Los Angeles County Assessor's Office surveys property in the County on a regular basis for tax levying purposes and creates the Assessor's Secured Abstract File (ASF) that is combined with the Los Angeles Department of City Planning and the Community Analysis Bureau data to create the Land Use Planning and Management Systems (LUPAMS). LUPAMS provides land use and zoning information on approximately 700,000 ownership parcels in the City of Los Angeles (City of Los Angeles Planning Data Systems Unit, 1975). These data can be aggregated to produce summary reports for major geographic areas within the City. Based on the LUPAMS file, current land use and zoning information can be described for the City and appropriate subareas.

For planning purposes the City is divided into 35 planning areas with each area responsible for the development of community plans for land use input into the overall citywide General Plan. Figure II-74 locates the 35 planning areas and identifies the cities of Beverly Hills, Santa Monica, Culver City, San Fernando, Glendale, El Segundo, and Burbank, which are not included in the 35 planning areas but are part of the wastewater service area.

Table II-23 gives the land use of Los Angeles and of the cities in the wastewater service area. The extent of land use development in most of the contract cities and unincorporated areas is well established; most additional development would have to be through the recycling of developed land (Figure II-75). Beverly Hills is predominantly a very low density-residential area with the highest median-house values in the nation (Lantis, Steiner, and Karinen, 1973). It is fully developed with little vacant land and should not experience drastic land use changes. Culver City is characterized by medium-density housing and areas of light industry and high intensity commercial activity. Recently, the movie industry has largely given way to the development of condominium complexes, but in general, the area has been fully developed (City of Los Angeles, Department of Public Works, 1975). The City of Santa Monica is a stable beach city characterized by medium density residential areas with concentrations of high intensity commercial and light industrial activities near the freeways. In the 1940's most of the remaining vacant land was converted to residential use (Lantis, Steiner, and Karinen, 1973). El Segundo, also located along the coast, is very stable in terms of land


SYLMAR
SAN FERNANDO
GRANADA HILLS KNOLLWOOD
SUNLAND TUJUNGA SHADOW HILLS LAKEVIEW TERRACE
PACOIMA – SUN VALLEY
N
W
E
S
NORTHRIDGE
CHATSWORTH – PORTER RANCH
MISSION HILLS PANORAMA CITY SEPULVEDA
VERDUGO MOUNTAINS
SAN FERNANDO VALLEY
RESEDA – WEST VAN NUYS
VAN NUYS
CANOGA PARK – WINNEKA – WOODLAND HILLS
BURBANK
NORTH HOLLYWOOD
UNIVERSAL CITY
GLENDALE
ENCINO – TARZANA
SHERMAN OAKS – STUDIO CITY
HOLLYWOOD
BEL AIR – BEVERLY CREST
NORTHEAST LOS ANGELES
CENTRAL
BRENTWOOD – PACIFIC PALISADES
BEVERLY HILLS
SILVER LAKE ECHO PARK
WESTWOOD
WILSHIRE
WESTERN LOS ANGELES
WEST LOS ANGELES CENTRAL CITY RANCHO PARK
WESTLAKE
CENTRAL CITY
BOYLE HEIGHTS
WEST ADAMS LEIMERT BALDWIN HILLS
SANTA MONICA
PALMS MAR VISTA DEL REY
NORTH & EAST CENTRAL CITY
VENICE
CULVER CITY
SOUTH CENTRAL LOS ANGELES
WESTCHESTER – PLAYA DEL REY
SOUTHEAST LOS ANGELES
EL SEGUNDO
TORRANCE GARDENA CORRIDOR
HARBOR
WILMINGTON – HARBOR CITY
SAN PEDRO
SCALE IN MILES
0 1 2 3 4 5

198P-38

Figure II-74. Los Angeles City planning areas within geographical boundaries and wastewater contract cities.

Table II-23. Land use in Los Angeles and wastewater contract cities.

AREA	RESIDENTIAL			COMMERCIAL	INDUSTRIAL	OPEN LAND/ AGRICULTURAL	PARKS/ RECREATION	PUBLIC SERVICES/ INSTITUTIONAL	OTHER MISC.	VACANT	TOTAL ACREAGE
	SINGLE FAMILY	MULTI-FAMILY	TOTAL								
BEVERLY HILLS (1974)											
Acres	2,053	229.6	2,282.6	267.4	3.9	—	73.5	93.5	—	38.2	2,759
Percent	74.4	8.3	82.7	9.7	0.1	—	2.7	3.4	—	1.4	100
BURBANK (1974)											
Acres	2,970	810	2,780	540	1,290	—	—	2,990	2,340	N.A.	10,940
Percent	27.1	7.4	34.5	4.9	11.8	—	—	27.3	21.4	N.A.	99.9
CULVER CITY (1973)											
Acres	N.A.	N.A.	1,643	527	341	—	31	186	217	155	3,100
Percent	N.A.	N.A.	53	17	11	—	1	6	7	5	100
EL SEGUNDO (1974)											
Acres	398	83	482	83	1,505	216	209	38	398	566	3,497
Percent	11.4	2.4	13.8	2.4	43.1	6.2	6.0	1.1	11.4	16.2	100
GLENDALE (1974)											
Acres	4,626	1,289	5,915	777	296	—	—	2,489	297	6,581	16,355
Percent	28.3	7.9	36.2	4.8	1.8	—	—	15.2	1.8	4.0	100
LOS ANGELES* (1976)											
Acres	123,039	726	145,765	12,331	15,061	8,876	3,142	4,767	44,559	75,445	309,924
Percent	39.7	7.3	47	3.9	4.9	27	1	1.5	14.4	24.3	99.7
SANTA MONICA (1976)											
Acres	1,358	1,019	2,377	308	415	16	205	443	1,527	43	5,334
Percent	25.5	19	44.5	5.8	7.7	0.3	3.9	8.4	28.6	0.8	100
SAN FERNANDO (1974)											
Acres	N.A.	N.A.	620	113	180	—	40	—	457	140	1,550
Percent	N.A.	N.A.	40	7.3	11.6	—	2.6	—	29.5	9	100

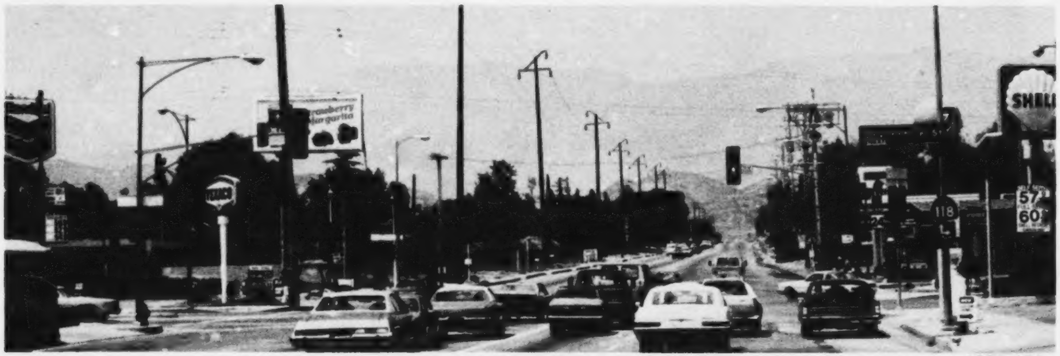
*SOURCE: City of Los Angeles Planning Data Systems Unit, 1976.

NOTE: Does not include invalid acreage totals, but does include both publicly and privately owned land.

use. It has large amounts of light and heavy industrial activities, including the oil industry and many aircraft related companies. The predominantly low-density residential section accounts for only 16 percent of the land use. The unincorporated Marina del Rey is composed of medium and high-density residential and low intensity commercial and industrial activities. Any additional development will have to occur by recycling existing developed land (Rood and Warren, 1974). Universal City, in the San Fernando Valley, is also in unincorporated County land. It is totally under one ownership, MCA. There are several high-rise office buildings and a movie studio now used primarily as a public amusement park; there are currently no residential or commercial developments in this unincorporated area.

The cities of Glendale, Burbank, and San Fernando, located in the east San Fernando Valley, are characterized by medium to high-density housing. Burbank and Glendale have many aircraft related companies, including the Lockheed Aircraft Company and the Burbank Airport. Burbank, like Glendale, has little vacant land exclusive of steep hillside slopes (Lantis, Steiner, and Karinen, 1973). Because the City of Los Angeles comprises approximately 84 percent of the Hyperion Service Area and 79 percent of the service system as a whole, it will be addressed separately.

The 1976 LUPAMS file has been used to generate the land use of Los Angeles given in Table II-23. From this table it can be seen that 47 percent of city acreage is used for residential purposes, 3.9 percent for commercial, and 4.9 percent for industrial. The remaining 44 percent is divided into agricultural uses (2.7 percent), recreational (1 percent), institutional (1.5 percent), vacant lands (24.3 percent), and other uses (14.4 percent). Combining vacant lands with acres in agricultural use results in a total of 27 percent, or 83,679 acres, of city land potentially developable.



198P-134

Figure II-75. Highways and streets comprise approximately 20 percent of the total land area of the City of Los Angeles. Note the four gasoline stations — one on each corner.

Variations of land uses within specific geographical areas in the City-Central Los Angeles, San Fernando Valley, Western Los Angeles, and the Harbor Area are evident in Figure II-72 and detailed in Table II-24. For example, the San Fernando Valley contains over three-quarters of the City's 8,876 acres devoted to agricultural uses (Figure II-76); Western Los Angeles had nearly all the remaining agricultural land with Central Los Angeles and the Harbor Area having only minimal acreage devoted to agriculture.

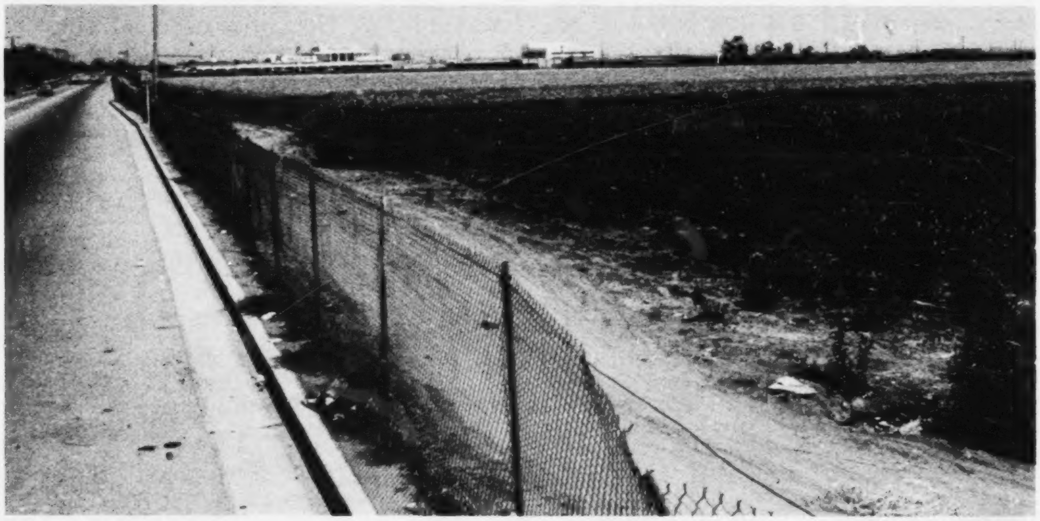
Table II-24. Land uses in geographical areas of Los Angeles.(1)

GEOGRAPHICAL AREA	AGRICULTURAL (NO. OF ACRES/ % OF CATEGORY)	RESIDENTIAL (NO. OF ACRES/ % OF CATEGORY)	COMMERCIAL (NO. OF ACRES/ % OF CATEGORY)	INDUSTRIAL (NO. OF ACRES/ % OF CATEGORY)	ALL OTHER USES (NO. OF ACRES/ % OF CATEGORY)	VACANT(2) (NO. OF ACRES/ % OF CATEGORY)
San Fernando Valley	6,890/78	73,188/50	4,990/40	6,336/42	21,329/41	39,055/52
Western Los Angeles	1,969/22	29,981/21	1,087/9	2,103/14	11,540/22	21,891/29
Central Los Angeles	8/0	37,739/26	5,675/46	4,237/28	14,085/27	10,962/14
Harbor Area	9/0	4,857/3	579/5	2,385/16	5,514/10	3,536/5
TOTALS	8,876/100	145,765/100	12,331/100	15,061/100	52,468/100	75,445/100

SOURCE: City of Los Angeles Planning Data Systems Unit.

(1) Data given does not include invalid acreage totals, but does include both publicly and privately owned land.

(2) Vacant lands do not include agricultural lands.



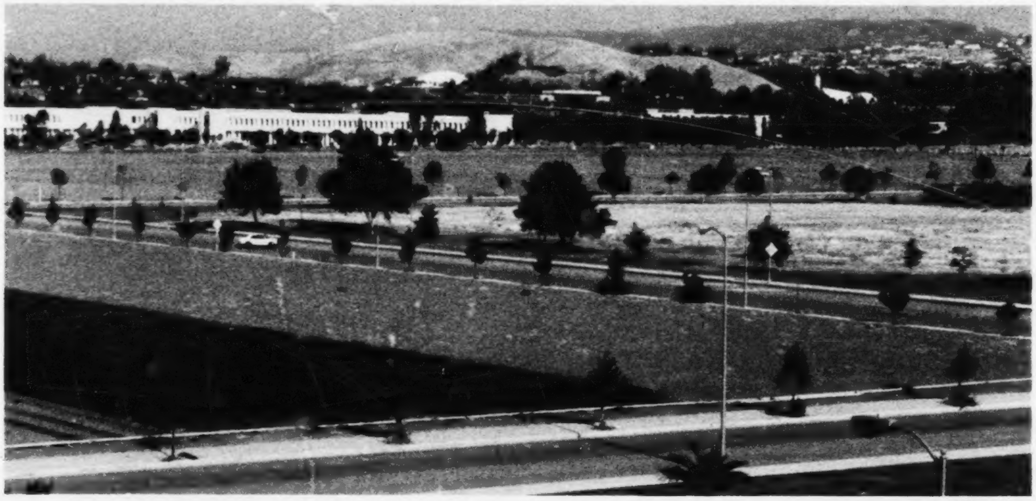
198P-36

Figure II-76. The San Fernando Valley contains approximately 6,900 acres devoted to agricultural uses. This parcel, between Plummer and Nordhoff Streets in the western end of the San Fernando Valley, has residential uses to the north, commercial to the east, and industry to the west and south. This area is slated for industrial development in the city planning guidelines for the community plans.

Residential acreage in the San Fernando Valley is about 50 percent of the 145,765 total acreage as compared to Central Los Angeles with 26 percent, Western Los Angeles with 21 percent, and the Harbor Area with 3.2 percent. A review of Figure II-72 shows existing multiple family residences concentrated in the Central City with relatively few multiple family dwellings in the San Fernando Valley.

The ratio of single to multiple family residential acreage is large, indicating the unique low-density residential character of Los Angeles. In the San Fernando Valley this ratio is 11 to 1 (i.e., 11 single family acres to 1 multi-family acre) and in Western Los Angeles it is 10 to 1. Even in the higher density Central City and Harbor areas, the ratios are 2 to 1 and 3 to 1, respectively (City of Los Angeles Planning Data Systems Unit, 1975).

Acreage devoted to commercial uses is greatest in Central Los Angeles, with about 46 percent of all commercial land within the Central area itself. The San Fernando Valley has 40 percent of the City's acreage zoned for commercial, with much of this in strip commercial and, more recently, the large land areas devoted to shopping centers (Figure II-77). Commercial acreage in Western Los Angeles and the Harbor Area represent 9 percent and 5 percent respectively of the citywide total. The majority of the white areas (Figure II-72) in the western and northwestern end of the San Fernando Valley where industrial development is beginning are currently in agriculture but are zoned chiefly industrial. The concentrated development of these areas is consistent with the planned Centers concept, discussed in greater detail in other sections of this chapter.

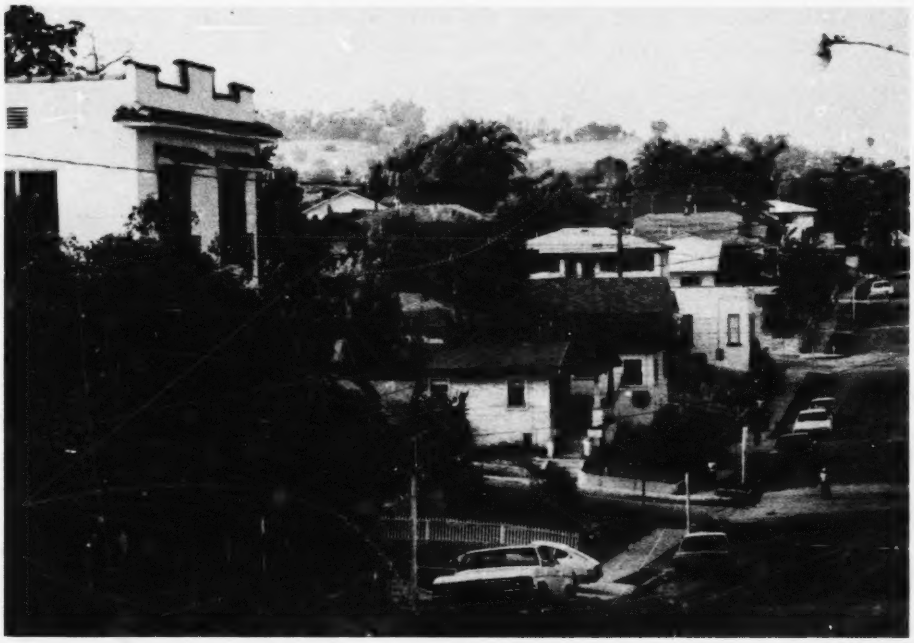


198P-135

Figure II-77. The concentrated development of area currently in agriculture such as this area on Topanga Canyon Boulevard is part of the planned centers concept. Note that off-site improvements, including streets, sidewalks, lighting, and street trees have been developed in anticipation of commercial and industrial expansion.

Industry in Central Los Angeles accounts for 28 percent of the total manufacturing while the relatively small Harbor Area has 16 percent of the manufacturing. Western Los Angeles contains 14 percent of the City's manufacturing lands while the remaining 42 percent is in the San Fernando Valley. It should be noted that the largest amount of manufacturing lands in the City are in the Valley. The Valley is the largest area of the City and residential is the largest use of this land, but industrial use for the City is concentrated in the Valley.

Community planning areas within each geographical area vary substantially in some cases from each other and from geographical totals. As Table II-25 shows, the Central City has little residential and recreational land use, but has most of its land in commercial and manufacturing activities (about 70 percent). Northeast Central Los Angeles also has nominal amounts of land in residential uses and about 47 percent devoted to commercial and manufacturing. This is reflective of the historical railroad link between downtown Los Angeles and the port at San Pedro that became of major importance with the annexation of the Wilmington and San Pedro areas in 1909 and the subsequent opening of the Panama Canal in 1914. The land use distribution in the community planning area of Westlake just east of the Central City is interesting to note, primarily because of its high percentage of multiple residential and commercial acreage (Figure II-78).



198P-136

Figure II-78. The Westlake area east of Central City has a high proportion of older multiple family units.

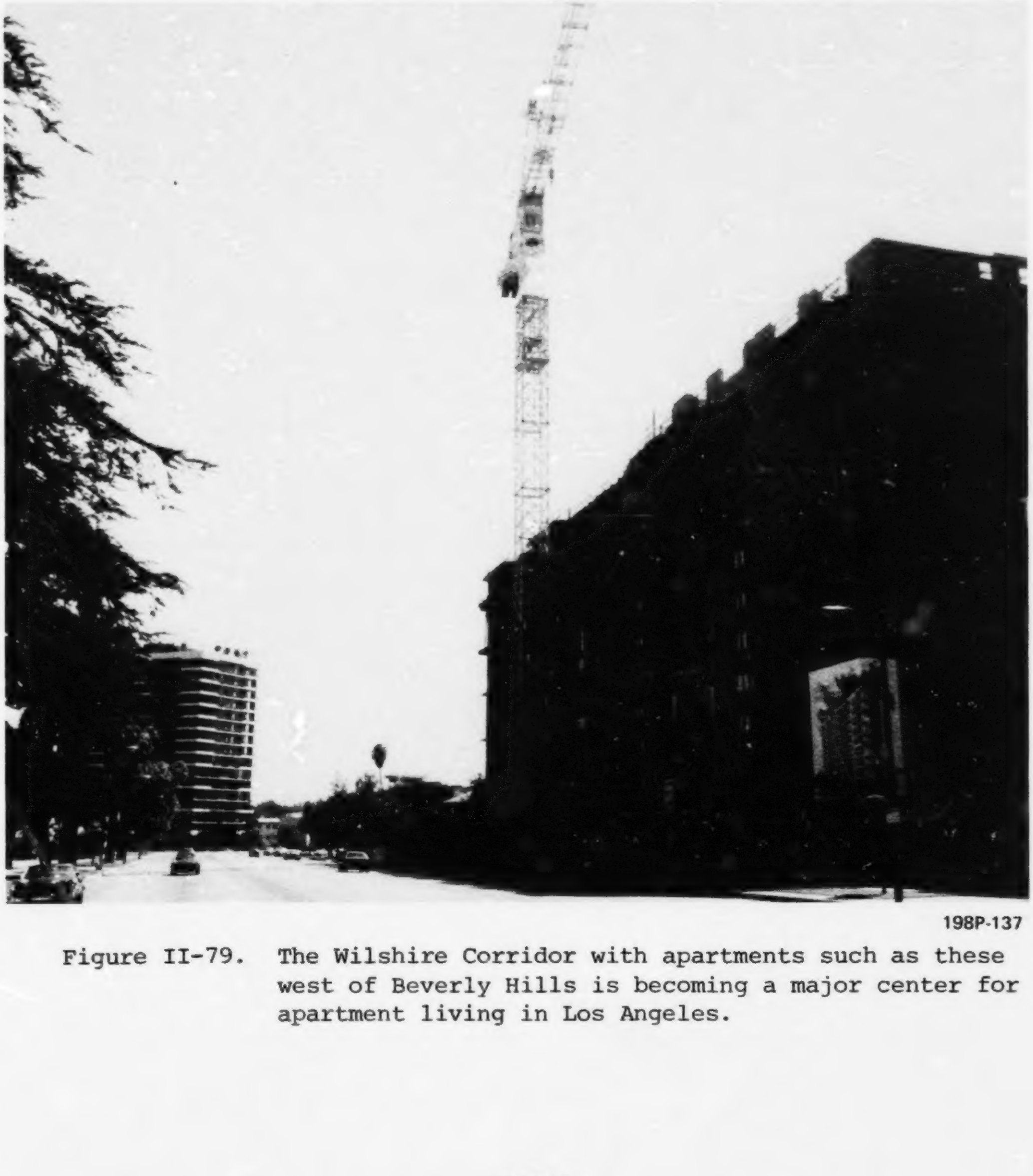
Table II-25. Land use and zoning in Central Los Angeles.

LAND USE PLANNING AREA	SINGLE	MULTIPLE	COMMERCIAL*	INDUSTRIAL	AGRICULTURAL	RECREATIONAL	INSTITUTIONAL	MISC.	INVALID	TOTAL ACREAGE
BALDWIN HILLS-WEST ADAMS										
Land Use										
Acres	3,093.5	1,515.1	535.1	259.9	0.6	8.9	109.8	400.7	28.0	5,951.6
Percent	52	25.5	9.0	4.4	0	0.1	1.8	6.7	0.5	100
Zoning										
Acres	2,198.5	2,695.4	688.4	305.3	0				63.9	5,951.5
Percent	36.9	45.3	11.6	5.1	0				1.0	99.9
BOYLE HEIGHTS										
Land Use										
Acres	525.4	641.8	210.3	478.4	0	3.2	162.0	594.0	0.9	2,616.0
Percent	20	24.5	8.1	18.3	0	0.1	6.2	22.7	0	99.9
Zoning										
Acres	21	1,307.5	300.3	916.4	0				70.6	2,615.8
Percent	0.8	50	11.5	35	0				3	100.3
CENTRAL CITY										
Land Use										
Acres	23.2	64.1	589.1	464.2	0	7.0	22.9	338.4	4.0	1,512.9
Percent	1.5	4.2	38.9	30.7	0	0	1.5	22.4	0	99.2
Zoning										
Acres	0	84	413.3	100.7	0				8.5	1,512.8
Percent	0	5.6	27	66.6	0				0.6	99.8
HOLLYWOOD										
Land Use										
Acres	4,953.6	1,881.0	731.9	406.1	0.8	22.0	650.9	3,938.6	1.9	12,586.8
Percent	39.3	14.9	5.8	3.2	0	0.2	5.2	31.3	0	99.9
Zoning										
Acres	6,970.4	2,495.2	968.7	219.7	0				1,932.6	12,586.8
Percent	55.3	19.8	7.7	1.7	0				15.4	99.9
NORTHEAST CENTRAL LOS ANGELES										
Land Use										
Acres	12.9	20.8	124.7	551.9	0	0.8	10.2	712.3	3.3	1,436.9
Percent	0.9	1.4	8.7	38.4	0	0	0.7	50	0	100.1
Zoning										
Acres	0	27.1	86.5	1,316.0	4.3				3.0	1,436.9
Percent	0	1.9	6.0	91.6	0.3				0.2	100
NORTHEAST LOS ANGELES										
Land Use										
Acres	6,214.5	1,665.4	546.5	838.4	5.1	50.2	547.5	2,588.5	1.3	12,457.4
Percent	50	13.3	4.4	6.7	0.04	0.4	4.4	20.8	0	100
Zoning										
Acres	4,709.3	4,009.4	776.8	1,090.9	118.2				1,752.9	12,457.5
Percent	37.8	32.2	6.2	8.8	0.9				14.1	100
WESTLAKE										
Land Use										
Acres	235.9	541.6	415.7	55.9	0	34.6	61.8	113.8	0.2	1,459.5
Percent	16.2	37.1	28.5	3.8	0	2.3	4.2	7.8	0	99.9
Zoning										
Acres	4.2	779.6	553.3	104.4	0				17.9	1,459.4
Percent	0.3	53.4	37.9	7.2	0				1.2	100
WILSHIRE-WEST WILSHIRE										
Land Use										
Acres	2,637.9	2,267.2	993.2	65.7	0	143.4	132.4	213.1	3.3	6,456.2
Percent	40.9	35	15.3	1.0	0	2.2	2.0	3.3	0	99.7
Zoning										
Acres	2,121.8	3,036.5	1,217.6	47.7	0				32.5	6,456.1
Percent	32.9	47	18.9	0.7	0				0.5	100
SILVERLAKE-ECHO PARK										
Land Use										
Acres	1,227.4	805.5	186.8	93.3	0.1	306.3	84.5	900.5	0	3,604.4
Percent	34	22.3	5.2	2.7	0	8.5	2.3	25	0	100
Zoning										
Acres	794.9	1,886.3	658.0	134.9	0				130.3	3,604.4
Percent	21.8	51.8	18.1	3.7	0				3.6	99
SOUTH CENTRAL										
Land Use										
Acres	3,299.0	1,934.0	694.7	146.8	1.1	94.0	378.0	439.9	0.3	6,987.8
Percent	47.2	27.7	9.9	2.1	0	1.3	5.4	6.3	0	99.9
Zoning										
Acres	1,563.0	3,940.2	1,129.0	164.2	0				191.2	6,987.6
Percent	22.4	56.4	16.2	2.3	0				2.7	100
SOUTHEAST LOS ANGELES										
Land Use										
Acres	2,646.7	1,532.7	647.9	876.0	0.1	6.5	143.3	864.9	23.9	6,742
Percent	39.2	22.7	9.6	13	0	0	2.1	12.8	0.3	99.7
Zoning										
Acres	400.7	3,727.4	970.3	1,206.4	0				437.2	6,742
Percent	5.9	55.3	14.4	17.9	0				6.5	100

*Commercial includes zoning designation of "parking."

This distribution is also evident in the Wilshire-West Wilshire Community Planning Area, although to a lesser degree. This multiple family dwelling land use pattern reflects the fact that both these planning areas encompass a major portion of the Wilshire Corridor which has intense commercial uses and is becoming a center of apartment living in Los Angeles *(Figure II-79)*.

The Community Planning Areas in Western Los Angeles (Table II-26) also vary with respect to each other and to the geographic-wide totals. The most extreme skewing of land uses occurs in the Bel Air - Beverly Crest area which is almost exclusively single family dwellings (see Figure II-80).



198P-137

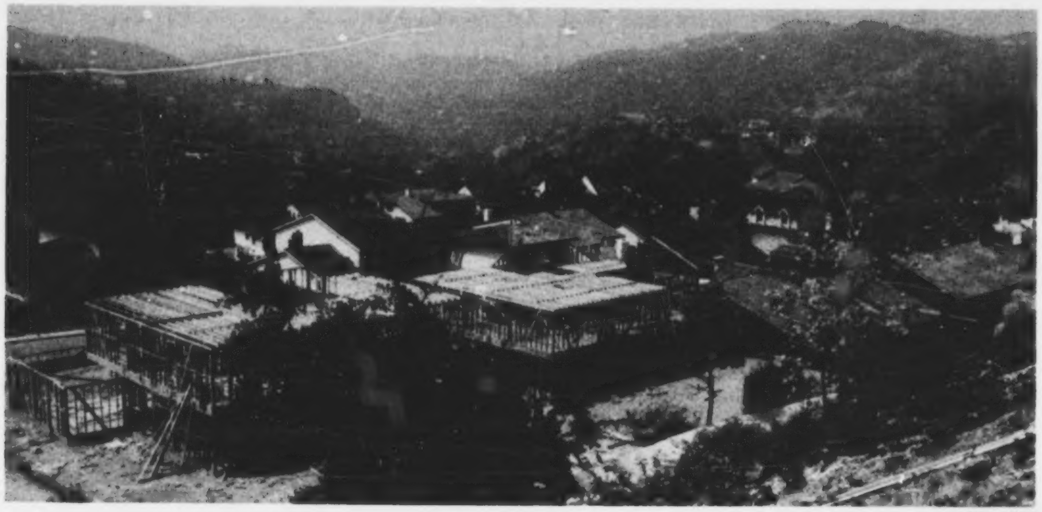
Figure II-79. The Wilshire Corridor with apartments such as these west of Beverly Hills is becoming a major center for apartment living in Los Angeles.

Table II-26. Land use and zoning in Western Los Angeles.

LAND USE PLANNING AREA	SINGLE	MULTIPLE	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	RECREATIONAL	INSTITUTIONAL	MISC.	INVALID	TOTAL ACREAGE
BEL AIR-BEVERLY CREST										
Land Use										
Acres	7,422.7	45.2	11.2	2.9	0	123.0	38.7	1,450.0	37.3	9,131.0
Percent	81.3	0.5	0.1	0.03	0	1.3	0.4	15.9	0.4	99.9
Zoning										
Acres	8,891.0	10.3	8.1	0	0				221.7	9,131.1
Percent	97.3	0.1	0.8	0	0				2.4	99.8
BRENTWOOD-PACIFIC PALISADES										
Land Use										
Acres	13,354.7	319.0	154.2	0	1,956.4	605.8	103.4	4,439.3	8.3	20,941.1
Percent	63.8	1.5	0.7	0	9.3	2.9	0.5	21.2	0.04	99.9
Zoning										
Acres	19,771.2	357.9	130.1	0	538.9			(0.8)	141.1	20,941
Percent	94.4	1.7	0.6	0	2.6			0	0.7	100
PALMS-MAR VISTA										
Land Use										
Acres	2,001.5	615.4	222.5	282.5	2.0	7.0	52.3	395.7	36.5	3,615.4
Percent	55	17	6	8	0	0.2	1.4	10.9	1	99.5
Zoning										
Acres	1,769.3	886.6	258.3	338.4	43.8			(19.03**)	300.0	3,615.4
Percent	48.9	24.5	7.1	9.4	1.2			(0.5)	8.3	99.9
VENICE										
Land Use										
Acres	624.3	323.0	83.0	36.6	10.4	0.8	13.0	308.2	3.0	1,402.3
Percent	44.5	23	5.9	2.6	0.7	0	0.9	22	0	99.6
Zoning										
Acres	476.0	502.0	127	58.5	0			(363*)	202.7	1,402.5
Percent	33.9	35.8	9.0	4.1	0			2.6	14.5	99.9
WEST LOS ANGELES-CENTURY CITY-RANCHO PARK										
Land Use										
Acres	1,634.1	514.8	336.3	212.9	0	141.6	49.7	172.7	17.0	3,079.1
Percent	53.1	16.7	10.9	6.9	0	4.6	1.6	5.6	0.6	100
Zoning										
Acres	1,598.4	705.7	332.5	346.4	0			(1.4**)	94.9	3,079.3
Percent	51.9	22.9	10.8	11.2	0			0	3.1	99.9
WESTCHESTER										
Land Use										
Acres	1,753.1	370.4	198.9	1,567.6	0	24.4	149.4	2,682.7	1.7	6,748.2
Percent	26	5.5	2.9	23.2	0	0.4	2.2	39.8	0.02	100
Zoning										
Acres	2,627.7	624.8	233	2,018.2	0.3				1,244.4	6,748.4
Percent	38.9	9.3	3.5	29.9	0				18.4	100
WESTWOOD										
Land Use										
Acres	722.6	280.0	80.7	0.7	0	286.9	43.9	451.7	3.4	1,869.9
Percent	38.6	15	4.3	0	0	15.3	2.3	24.2	0.2	99.9
Zoning										
Acres	744.8	722.5	84.1	4.6	285.3				28.5	1,869.8
Percent	39.8	38.6	4.5	0.2	15.3				1.5	99.9

*Submerged Land and Tentative Classification

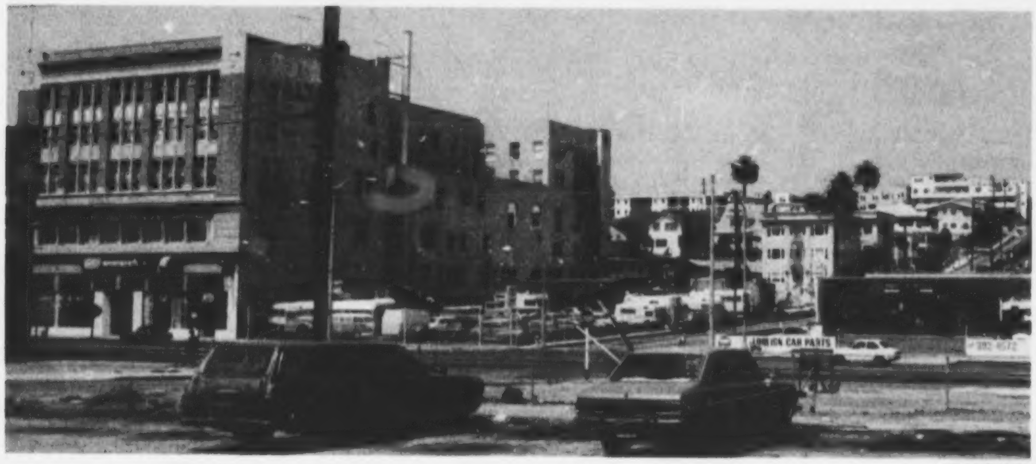
**Qualified Commercial Classification



198P-138

Figure II-80. The Beverly Crest area, pictured here, along with Bel Air is nearly exclusively single family dwellings built along the ridge lines on the north slope of the Santa Monica mountains.

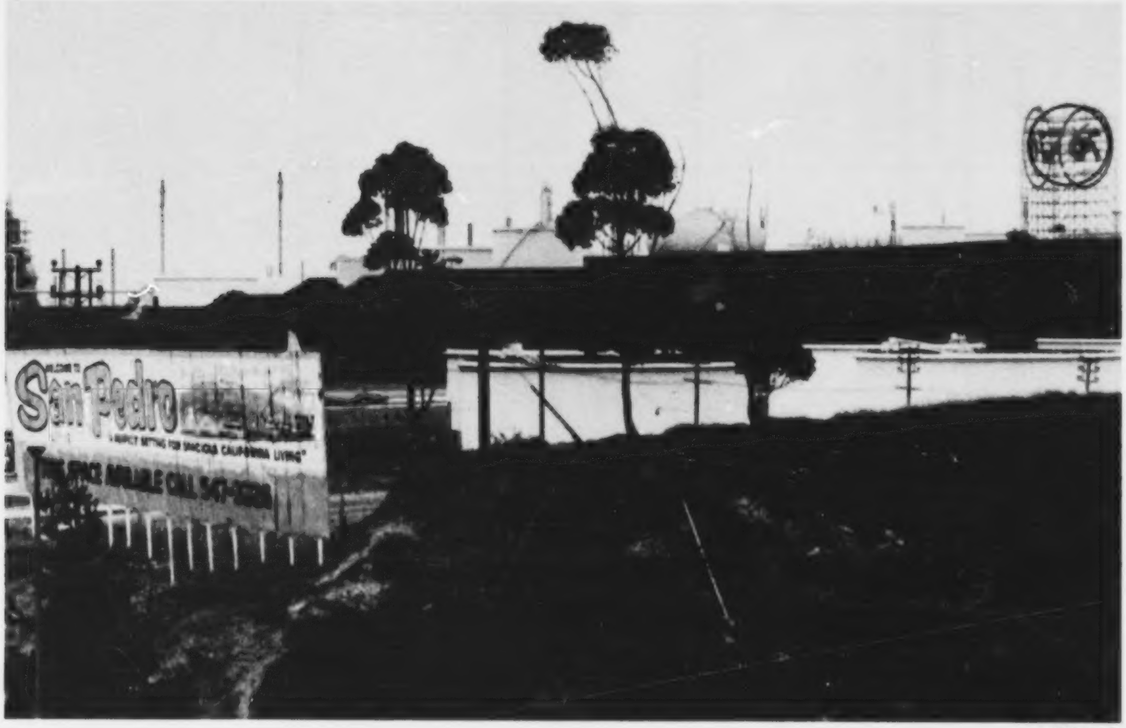
Westwood and Venice show a more balanced mix of single and multiple residential, commercial, and manufacturing uses with more acreage devoted to multiple dwelling unit use in Venice than in any other area (Figure II-81). Westchester has substantially more land devoted to manufacturing uses and less to single family homes than do other areas.



198P-139

Figure II-81. Venice contains more acreage devoted to multiple family use than any other community planning area in the city. Each apartment seeks western exposure with a glimpse of the ocean.

The community planning areas within the Harbor Area (Table II-27) are very similar to each other in their allocation of land to manufacturing uses; however, differences occur among the areas in the *type* of manufacturing uses. Both Wilmington-Harbor City and San Pedro are heavily oriented to petroleum and petroleum related activities including refineries, oil storage tanks, processing plants, and pipelines (Figure II-82). The Torrance-Gardena Strip has much less of its manufacturing activities devoted to such uses, but has about twice as much of its total area in manufacturing uses than does Wilmington-Harbor City.



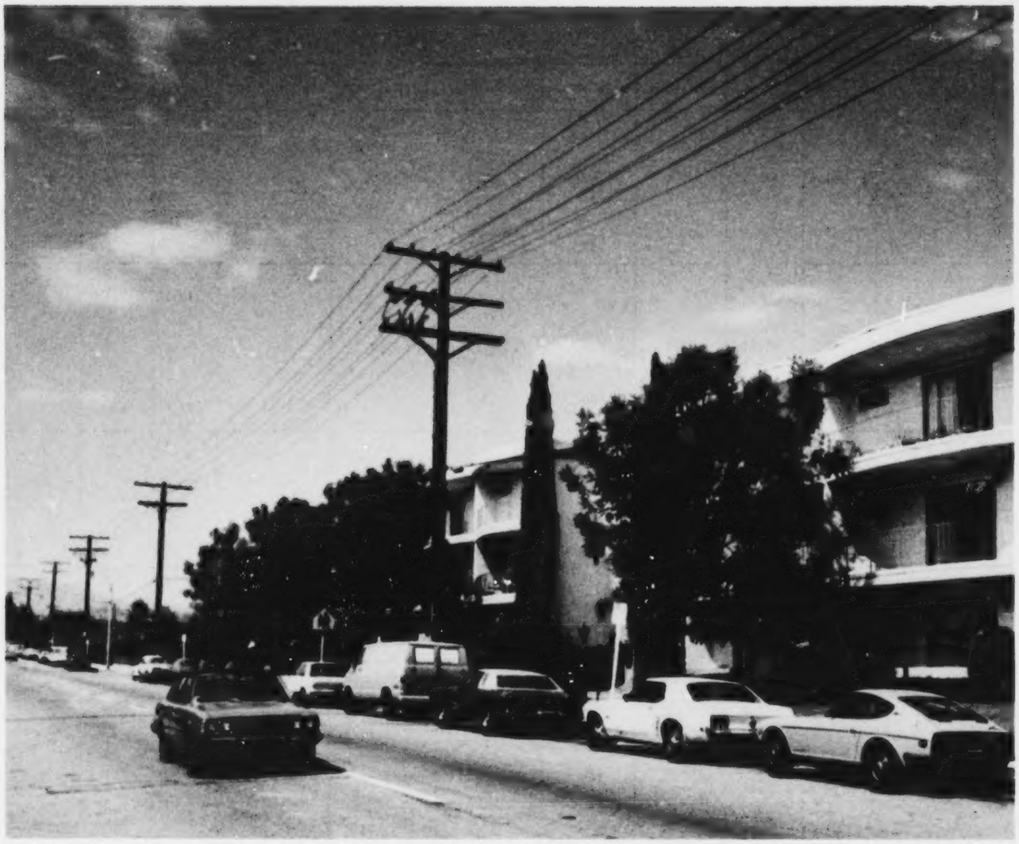
198P-140

Figure II-82. Heavy industry, particularly oil and shipping, dominate the Los Angeles Harbor Area.

The community planning areas in the San Fernando Valley, for the most part, are devoted to extensively developed single-family residential use (see Figure II-83). Of the 15 communities detailed in Table II-28, only Granada Hills-Knollwood, Sun Valley, and Sunland-Tujunga-Shadow Hills have more than 50 percent of their respective areas devoted to land use other than single family residential.

Table II-27. Land use and zoning in the Harbor Area.

LAND USE PLANNING AREA	SINGLE	MULTIPLE	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	RECREATIONAL	INSTITUTIONAL	MISC.	INVALID	TOTAL ACREAGE
TORRANCE STRIP-GARDENA STRIP										
Land Use										
Acres	840.5	200.5	84.1	962.0	1.5	46.1	8.3	261.2	0	2,422.2
Percent	34.7	8.3	3.5	39.7	0.06	2.6	0.3	10.8	0	100
Zoning										
Acres	640.2	412.2	88.2	1,147.0	0				134.5	2,422.1
Percent	26.4	17.0	3.6	47.3	0				5.6	99.9
SAN PEDRO										
Land Use										
Acres	1,462.7	593.9	158.8	101.2	7.5	38.7	37.9	1,848.9	0	4,251.6
Percent	34.4	14	3.7	2.3	0.2	0.9	0.9	43.5	0	99.9
Zoning										
Acres	1,291.5	987.4	220.5	251.8	0				1,500.4	4,251.6
Percent	30.4	23.2	5.2	5.9	0				35.3	100
WILMINGTON-HARBOR CITY										
Land Use										
Acres	1,370.1	369.0	336.7	1,322.3	0.1	28.0	57.4	3,167.5	9.7	6,680.8
Percent	20.8	5.5	5	19.8	0	0.4	0.9	47.4	0.2	100
Zoning										
Acres	1,134.6	900.9	343.9	3,057.9	0				1,243.6	6,680.9
Percent	17.0	13.5	5.1	45.8	0				18.6	100



198P-141

Figure II-83. Multiple family dwellings are not typical in the San Fernando Valley although there are units, such as these immediately west of San Fernando Valley State University, that meet the needs of singles, young marrieds, and retired residents.

Only North Hollywood and Van Nuys-North Sherman Oaks have more than 10 percent of their area in multi-family residential use. Commercial uses account for between 1 percent and 10 percent of land area in the Valley communities with the Verdugo Mountains having the least and North Hollywood having the most. Manufacturing uses are mainly in Chatsworth-Porter Ranch, with 10 percent, and Sun Valley, with 26.5 percent; other areas vary between 2 percent and 7.6 percent.

The northern most Valley planning areas between Chatsworth-Porter Ranch and the Verdugo Mountains have substantial land areas devoted to agricultural uses, generally exceeding other community planning areas in

Table II-28. Land use and zoning in the San Fernando Valley.

LAND USE PLANNING AREA	SINGLE	MULTIPLE	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	RECREATIONAL	INSTITUTIONAL	MISC.	INVALID	TOTAL ACREAGE
CHATSWORTH-PORTER RANCH										
Land Use										
Acres	6,160.4	384.4	410.4	1,191.5	858.8	149.7	105.5	1,939.8	25.2	11,225.7
Percent	54.9	3.4	3.7	10.6	7.7	1.3	0.9	17.3	0.2	100
Zoning										
Acres	5,068.5	216.0	354.4	1,454.1	4,092.9				39.8	11,225.7
Percent	45.1	1.9	3.2	13.0	36.5				0.3	100
CANOGA PARK-WINNETKA-WOODLAND HILLS										
Land Use										
Acres	10,546.1	402.8	821.4	512.5	260.6	73.2	318.5	1,602.9	17.1	14,555.1
Percent	72	2.8	5.6	3.5	1.8	0.5	2.2	11	0.1	99.5
Zoning										
Acres	10,546.0	478.5	784.8	550.0	2,122.1				73.8	14,555.2
Percent	72	3.3	5.4	3.8	14.6				0.5	99.6
ENCINO-TARZANA										
Land Use										
Acres	6,665.4	390.3	301.9	17.2	19.0	389.6	112.4	2,903.4	29.0	10,828.2
Percent	61.5	3.6	2.8	0.2	0.2	3.6	0.1	26.8	0.3	100
Zoning										
Acres	8,504.2	243.9	343.3	21.7	1,073.5				641.6	10,828.2
Percent	78.5	2.3	3.2	0.2	9.9				5.9	100
SYLMAR										
Land Use										
Acres	3,446.5	334.2	190.6	437.8	512.6	20.7	223.8	1,173.7	2.1	6,342
Percent	54.3	5.3	3	6.9	8	0.3	3.5	18.5	0	99.8
Zoning										
Acres	3,359.6	106.2	193.6	372.2	2,305.3			(2.6*)	2.3	6,341.8
Percent	53.0	1.7	3.1	5.9	36.3			(0.04*)	0.03	100
VAN NUYS-NORTH SHERMAN OAKS										
Land Use										
Acres	3,242.0	902.5	486.6	449.0	0	36.8	148.2	634.4	11.9	5,911.4
Percent	54.8	15.3	8.2	7.6	0	0.6	2.5	10.7	0.2	99.9
Zoning										
Acres	3,241.3	1,359.6	549.7	691.4	2.6				66.6	5,911.2
Percent	54.8	23	9.3	11.7	0				1.1	99.9
VERDUGO MOUNTAINS										
Land Use										
Acres	4,247.5	246.3	82.9	143.0	2,269.5	48.5	82.8	435.9	11.0	7,567.4
Percent	34.5	3.3	1.0	1.9	30.0	0.6	1.1	5.8	0.1	99.8
Zoning										
Acres	2,610.0	79.1	91.4	35.9	4,713.9				37.0	7,567.3
Percent	34.5	1	1.2	0.5	62.3				0.5	100
GRANADA HILLS-KNOLLWOOD										
Land Use										
Acres	4,643.7	180.1	214.2	368.5	1,730.6	165.2	111.7	2,244.1	3.4	9,661.5
Percent	48.1	1.9	2.2	3.8	17.9	1.7	1.2	23.2	0	100
Zoning										
Acres	4,257.6	90.5	197.9	4.2	5,101.9				7.2	9,659.3
Percent	44.1	0.9	2.0	0.04	52.8				0.07	99.9
MISSION HILLS-PANORAMA CITY-SEPULVEDA										
Land Use										
Acres	5,001.2	401.8	453.9	248.1	4.6	27.3	218.7	912.4	19.2	7,287.2
Percent	68.6	5.5	6.2	3.4	0	0.4	3	12.5	0.3	99.9
Zoning										
Acres	5,513.8	429.6	470.6	318.0	527.5				27.6	7,287.1
Percent	75.7	5.9	6.5	4.4	7.2				0.4	100.1

*Tentative Classification

Table II-28 (Cont).

LAND USE PLANNING AREA	SINGLE	MULTIPLE	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	RECREATIONAL	INSTITUTIONAL	MISC.	INVALID	TOTAL ACREAGE
NORTH HOLLYWOOD										
Land Use										
Acres	2,552.0	845.9	504.9	322.5	42.3	25.2	120.2	514.8	5.5	4,933.3
Percent	51.7	17.1	10.2	6.5	0.9	0.5	2.4	10.4	0.1	99.8
Zoning										
Acres	2,182.6	1,645.2	578.8	488.4	0.3				37.9	4,933.2
Percent	44.2	33.3	11.7	9.9	0				0.8	99.9
NORTHRIDGE										
Land Use										
Acres	2,596.5	177.4	188.8	126.3	6.7	12.1	74.0	603.3	6.2	3,789.3
Percent	68.5	4.7	5.0	3.3	0.2	0.3	2.0	15.9	0.2	100.1
Zoning										
Acres	2,827.2	196.0	297.5	197.1	304.9				6.6	3,789.3
Percent	74.6	4.2	7.9	5.2	8.0				0.2	100.1
PACOIMA-ARLETA-LAKEVIEW TERRACE										
Land Use										
Acres	2,880.4	220.8	244.8	328.8	327.6	35.4	76.8	1,357.5	0	5,472.1
Percent	52.6	0.4	4.4	6	6	0.6	1.4	24.8	0	99.8
Zoning										
Acres	3,081.0	98.0	210.8	477.4	1,604.7				0	5,471.9
Percent	56.3	1.8	3.9	8.7	29.3				0	100
RESEDA-WEST VAN NUYS										
Land Use										
Acres	3,230.9	412.6	280.8	343.5	0	26.9	80.2	1,125.2	8.7	5,508.8
Percent	58.7	7.5	5.1	6.2	0	0.5	1.5	20.4	0.2	100.1
Zoning										
Acres	4,026.3	456.8	295.6	673.6	8.2				59.7	5,520.2
Percent	72.9	8.3	5.4	12.2	0.1				1.1	100
SHERMAN OAKS-STUDIO CITY-TOLUCA LAKE										
Land Use										
Acres	5,818.9	719.4	434.3	84.5	4.1	117.8	94.6	307.9	16.9	7,598.4
Percent	76.6	9.5	5.7	1.1	0	1.5	1.2	4	0.2	99.8
Zoning										
Acres	6,087.1	862.9	533.9	37.2	41.9				35.6	7,598.6
Percent	80.1	11.4	7	0.5	0.6				0.5	100.1
SUNLAND-TUJUNGA-SHADOW HILLS										
Land Use										
Acres	3,560.0	313.8	110.3	116.5	826.7	7.6	85.5	966.2	1,808.3	7,794.9
Percent	45.7	4	1.4	1.5	10.6	0	1.0	12.4	23	99.6
Zoning										
Acres	2,971.8	277.7	138.6	21.1	2,132.4				2,253.2	7,794.8
Percent	38.1	3.6	1.8	0.3	27.4				28.9	100.1
SUN VALLEY										
Land Use										
Acres	2,371.3	293.0	263.8	1,647.0	27.7	9.0	54.5	1,557.3	0.5	6,224.1
Percent	38.1	4.7	4.2	26.5	0.4	0.1	0.9	25	0	99.9
Zoning										
Acres	2,749.8	183.5	276.3	2,444.5	500.3			(22.0*)	47.7	6,224.1
Percent	44.2	2.9	4.4	39.3	8			(0.4)	0.8	100

*Qualified Industrial

the City (Figure II-84). The Verdugo Mountains and Granada Hills-Knollwood have the most agriculture of any community planning area in the City with approximately 30 percent and 18 percent respectively.

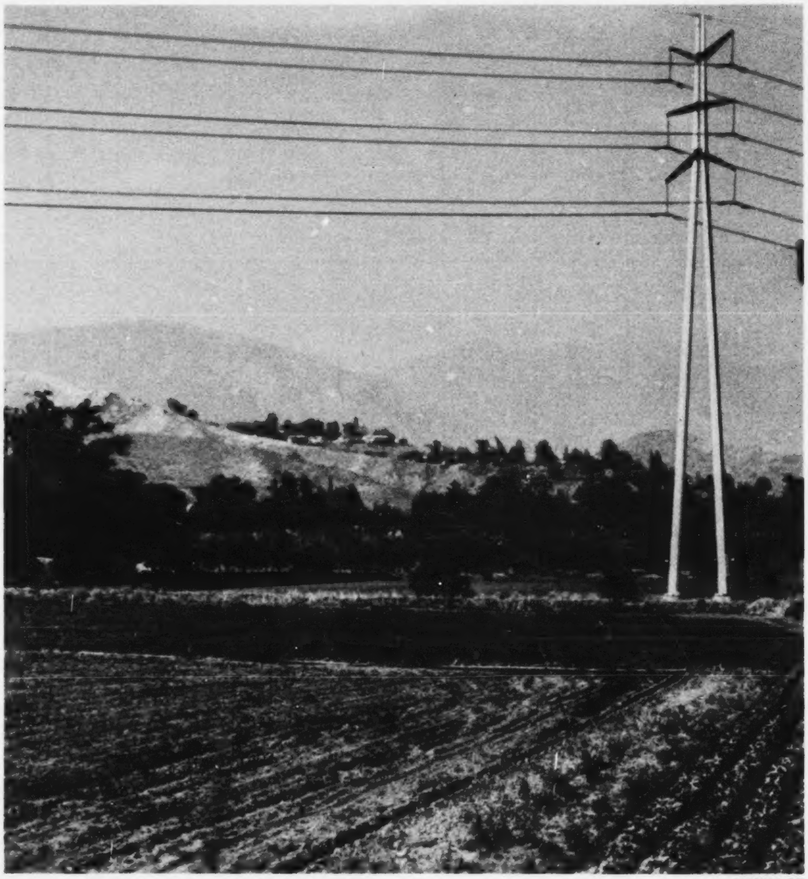
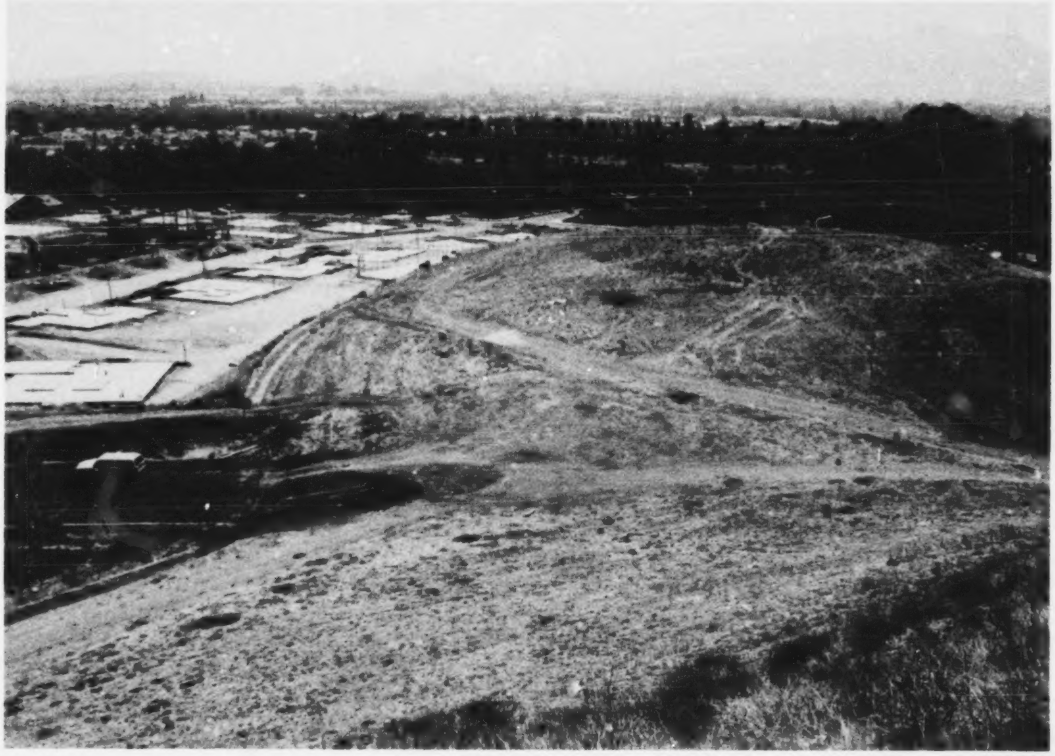

198P142

Figure II-84. Agricultural land in the city is concentrated in the northern sections of the San Fernando Valley. The 1945 City Plan for the Valley stated: "Agriculture, important to the economy of the Valley and of the metropolitan area, should be encouraged to develop further and be adequately protected against indiscriminate encroachment by town lot subdivisions."

The extensive development of Los Angeles, with residential use concentrated in single family dwellings, requires an extensive sewage system to collect and concentrate the flows for cost effective treatment. In addition, land available for development or recycling has the potential for increasing flow rates beyond the hydraulic capacity of the existing system. The location of remaining vacant land in the City and other land not developed to maximum zoning are good indications of the areas which will be urbanized in the future (see Figure II-85). Table II-29 details the remaining privately owned vacant land in the City of Los Angeles. Figures are given by zoning categories in each of the 35 planning areas and the four geographical areas of the City. A complete breakdown of vacant land parcels, both publicly and privately owned, is included in Appendix IV.A. This discussion concentrates on only privately held acreage.

Vacant land comprises 87,534 acres in the City, 58 percent of which is privately owned. Vacant land in the San Fernando Valley accounts for about one-half of the City vacant land privately held. Vacant land in Central Los Angeles, Western Los Angeles, and the Harbor Area comprise 12 percent, 28 percent, and 5 percent of the total city vacant land not publicly held. Within the community planning areas, the majority of non-public vacant land is located in Brentwood-Pacific Palisades (19 percent), Sunland-Tujunga-Shadow Hills-Lake View Terrace (11 percent), and Verdugo (10 percent).



198P-37

Figure II-85. Portions of the San Fernando Valley's 27,300 vacant areas are being developed in residential subdivisions. View west from Chatsworth toward the Santa Susana Mountains during July of 1976.

Table II-29. Privately owned vacant land summary by zones in the City of Los Angeles Planning Areas.

GEOGRAPHICAL AREA	ZONED AGRICULTURE		ZONED RESIDENTIAL		ALL OTHER ZONING		TOTAL VACANT LAND	
Planning Area	# ACRES	# PARCELS	# ACRES	# PARCELS	# ACRES	# PARCELS	# ACRES	# PARCELS
CENTRAL LOS ANGELES	82	36	4,741	19,976	1,243	7,858	6,066	28.980
Wilshire	0	0	141	788	121	473	262	1,261
Westlake	0	0	69	496	77	508	146	1,004
Southeast Los Angeles	0	0	198	1,834	247	1,936	445	3,770
Central City	0	0	8	41	182	1,391	190	1,432
Hollywood	0	0	2,334	5,098	81	431	2,415	5,529
Northeast Los Angeles	82	36	1,559	8,843	191	976	1,832	9,855
South Central Los Angeles	0	0	141	950	130	931	271	1,881
Silverlake-Echo Park	0	0	246	1,562	81	368	327	1,930
North & East Central City	0	0	5	47	79	443	84	490
Boyle Heights	0	0	40	317	54	401	94	718
WESTERN LOS ANGELES	553.2	9	13,273	8,721	465	1,547	14,291.2	10,277
Palms-Mar Vista del Rey	31	4	50	333	65	205	146	542
West Adams-Leimert-Baldwin Hills	0	0	164	657	105	528	269	1,185
Century City-Rancho Park-West Los Angeles	0	0	39	305	41	209	80	509
Brentwood-Pacific Palisades	522	4	9,042	1,814	40	76	9,604	1,894
Venice	0	0	114	1,060	21	264	135	1,324
Westchester	0	0	124	1,053	186	216	310	1,269
Bel Air-Beverly Crest	0	0	3,719	3,408	0	2	3,719	3,410
Westwood	2	1	21	91	7	52	28.2	144
SAN FERNANDO VALLEY	11,944	1,701	11,194	17,493	1,845.5	2,981	24,983.5	22,175
Granada Hills-Knollwood	2,085	163	166	393	12	27	226.3	583
Encino-Tarzana	0	0	1,727	1,099	35	85	1,762	1,184
Canoga Park-Winnetka-Woodland Hills	1,052	166	2,052	2,931	189	325	3,293	3,422
Chatsworth-Porter Ranch	1,626	287	1,579	2,745	614	297	3,819	3.329
Mission Hills-Sepulveda-Panorama City	39	22	348	792	69	164	456	978
North Hollywood	0	0	155	461	74	332	229	793
Northridge	121	35	165	268	42	57	328	360
Reseda-West Van Nuys	0	0	205	466	68	126	273	592
Pacoima-Sun Valley	105	56	367	983	442	652	914	1,691
Sherman Oaks-Studio City	0	0	1,734	2,624	45.5	259	1,779.5	2,883
Van Nuys	0	0	112	516	69	239	181	755
Verdugo	4,238	669	945	1,222	30	136	5,213	2,027
Sylmar	740	103	718	934	119	123	1,577	1,160
Sunland-Tujunga-Shadow Hills-Lakeview Terrace	1,938	200	921	2,059	37	159	2,896	2,418
HARBOR AREA	0	0	446	1,962	1,834	3,411	2,280	5,373
Torrance-Gardena Strip	0	0	49	206	344	147	393	353
Wilmington-Harbor City	0	0	212	943	1,439	2,982	1,651	3,925
San Pedro	0	0	185	813	51	282	236	1,095
LOS ANGELES TOTAL	12,579.2	1,746	29,654	48,152	5,387.5	15,797	47,620.7	65,695

As Table II-29 shows, at least 1,000 acres of vacant agriculturally zoned land are located in each of several San Fernando Valley communities, including the Verdugo Mountains, Chatsworth-Porter Ranch, Granada Hills-Knollwood, Sunland-Tujunga-Shadow Hills-Lake View Terrace, and Canoga Park-Winnetka-Woodland Hills. The complete vacant lands summary in Appendix IV.B indicates that of the residentially zoned land, vacant single family zoned property is most prevalent in Brentwood-Pacific Palisades, Hollywood, Bel Air-Beverly Crest, Encino-Tarzana, Canoga Park-Winnetka-Woodland Hills, Northeast Los Angeles, Sherman Oaks-Studio City, and Chatsworth-Porter Ranch (Figure II-86).

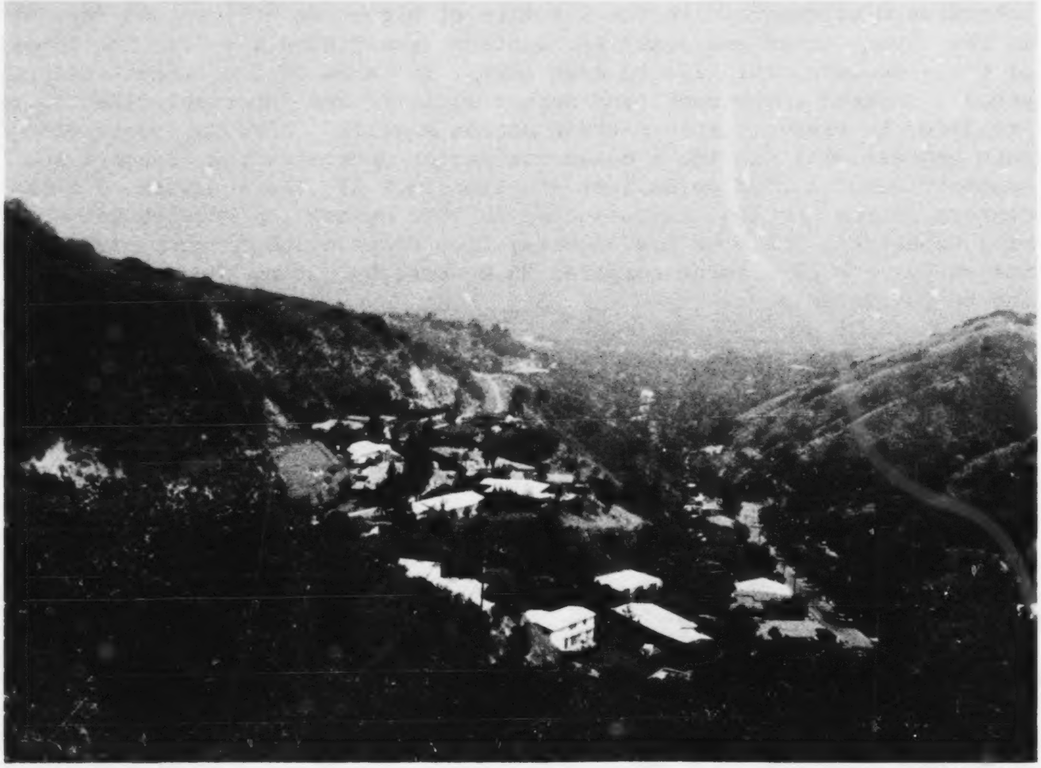

198P–143

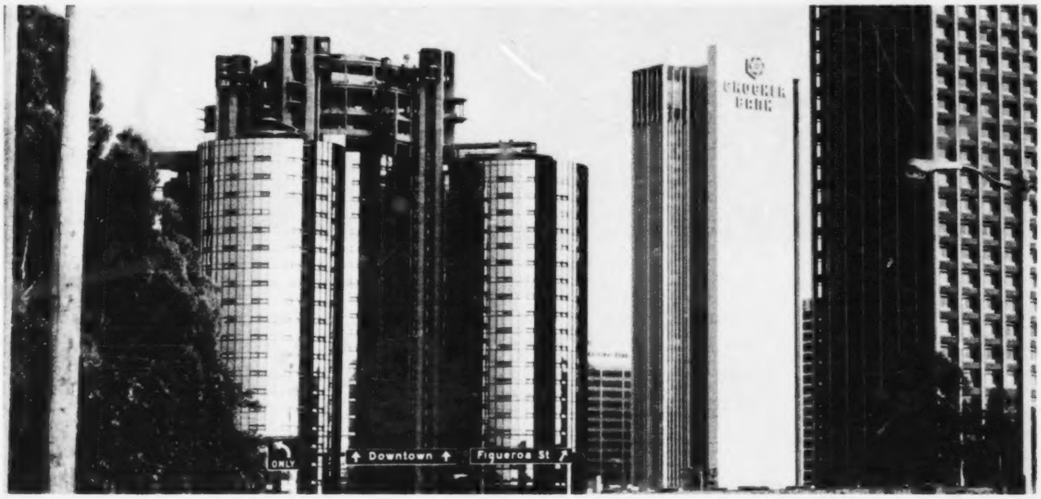
Figure II-86. Vacant land in the Encino-Tarzana area and in other mountainous areas that ring the San Fernando Valley is rugged with steep slopes but typical of that which has been developed residentially in the Sherman Oaks-Studio City planning area.

Vacant multiple residentially zoned land is most prevalent in Brentwood-Pacific Palisades, Southeast Los Angeles, Northeast Los Angeles, West Adams-Leimert-Baldwin Hills, Silverlake-Echo Park, South Central

Los Angeles, Wilmington-Harbor City, North Hollywood, and Canoga Park-Winnetka-Woodland Hills. While the largest totals of vacant land in single family zones are over 1,000 acres, the largest totals of vacant land in multiple family zones are not more than a few hundred acres. Sites over 5 acres in size which are typical of parcels that could be subdivided for future residential development are generally located in the San Fernando Valley and in the Western Santa Monica and Verdugo Mountains.

a. Community Centers. Population growth, rising land values, and the rescinding of the 13-story height limitation in 1957 have resulted in more intensive development with the erection of high-rise offices and residences in the Civic Center and auxiliary centers (see Figure II-87). The importance of these centers, relative to each other, in terms of the concentration of people, capital investment, and market activity are important clues to understanding the present urban pattern of Los Angeles. Also, a description of such centers will provide a basis for better understanding "Concept Los Angeles" General Plan guidelines (Section II.E.2). An analysis of urban centers in Los Angeles was conducted in 1972 by the Los Angeles City Planning Department (City of Los Angeles, City Planning Department, 1972). In its study, the Department compared 26 centers by rating the centers according to 10 criteria:

1. Current population density,
2. Anticipated growth to 1990,
3. Average assessed land value per square foot,
4. Land assessment as a percentage of total assessment,



198P–155

Figure II-87. Los Angeles Downtown has undergone major development, is a major employment center, and contributes to the net import of over 150,000 jobs daily.

5. Total assessed value per net acre,
6. Total assessed value per capita,
7. Percentage of existing other-than-low density zoning,
8. Current employment per net acre,
9. Anticipated employment expansion to 1990,
10. Current retail sales per gross acre.

Centers were then ranked within each category and by all categories. As a result, the study concluded that the centers could be rated in the following manner:

PRIMARY CENTERS:

1. Century City
2. Civic Center-Downtown
3. Wilshire-Downtown
4. Miracle Mile-Wilshire
5. Sherman Oaks
6. Westwood
7. Hollywood

SECONDARY CENTERS:

8. Westchester-Airport
9. Studio City-Universal
10. North Hollywood
11. Exposition Park
12. Crenshaw
13. Van Nuys
14. Panorama City
15. Canoga-Woodland Hills

TERTIARY CENTERS:

16. San Pedro
17. Vernon-Central
18. Venice
19. Avalon-Manchester
20. Reseda
21. Boyle Heights
22. Watts

SATELLITE OR COMMUNITY CENTERS:

23. Highland Park
24. Chatsworth
25. Northridge
26. Lincoln Heights

The locations of these centers along with those of other communities in or near the wastewater service area are shown in Figure II-88. The

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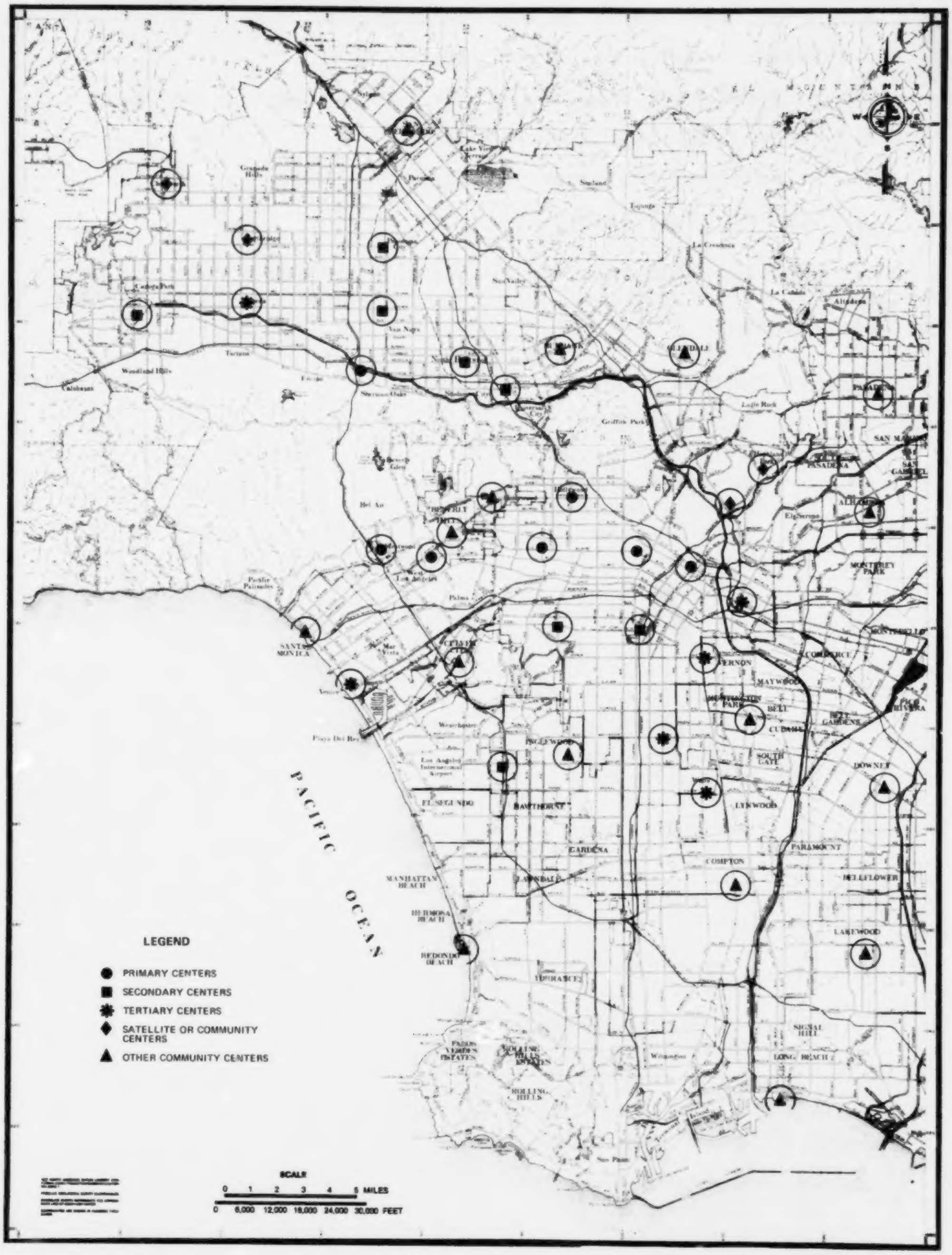

PACIFIC
OCEAN
SANTA MONICA
VENICE
Playa Del Rey
Los Angeles International Airport
EL SEGUNDO
HAWTHORNE
GARDENA
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
TORRANCE
VERNON
MAYWOOD
BELL
CUDAHY
SOUTH GATE
LYNWOOD
COMPTON
PARAMOUNT
BELLFLOWER
DOWNEY
LAKEWOOD
SIGNAL HILL
LONG BEACH
COMMERCE
MONTEREY PARK
ALHAMBRA
PASADENA
GLENDALE
BURBANK
Griffith Park
Woodland Hills
Calabasas
Tarzana
Encino
Sherman Oaks
Van Nuys
North Hollywood
Sun Valley
Sunland
Tujunga
La Crescenta
La Canada
Altadena
Granada Hills
Canoga Park
Pacific Palisades
Bel Air
Beverly Glen
BEVERLY HILLS
West Los Angeles
Palms
CULVER CITY
Mar Vista
Westchester
INGLEWOOD
LAWNDALE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
Wilmington
San Pedro
Eagle Rock
El Sereno
LEGEND
PRIMARY CENTERS
SECONDARY CENTERS
TERTIARY CENTERS
SATELLITE OR COMMUNITY CENTERS
OTHER COMMUNITY CENTERS
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET

198P—161

Figure II-88. Locations of centers in Los Angeles and adjacent communities.

majority of these centers have their roots in the history of the City: Westwood as the area surrounding the University of California at Los Angeles (Figure II-89), Hollywood as the center of the movie and television industry, the Civic Center as the birthplace of Los Angeles, and various areas in the San Fernando Valley as centers that arose from the agricultural pattern established in the late 1880s. Century City is a more recent center that was created in the early 1960s by Alcoa from land originally owned by 20th Century Fox and has become a new office employment center (see Figure II-90).

Certain locations, such as developing Topanga Canyon Boulevard in the west end of the San Fernando Valley (Figure II-91) and the Los Angeles Airport area (Figure II-92) have developed as centers of commercial and industrial activity from large agricultural lots.

The only centers that retain agricultural zoning today are in the central and western areas of the San Fernando Valley. The center with the greatest current agricultural area, Canoga-Woodland Hills, is slated for

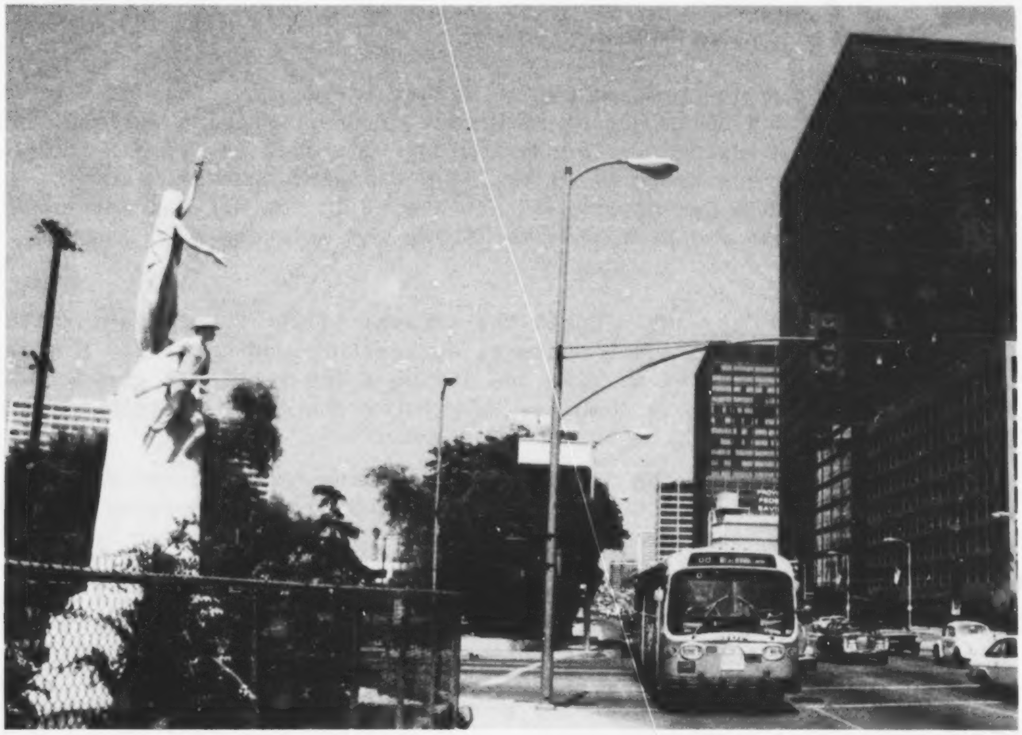
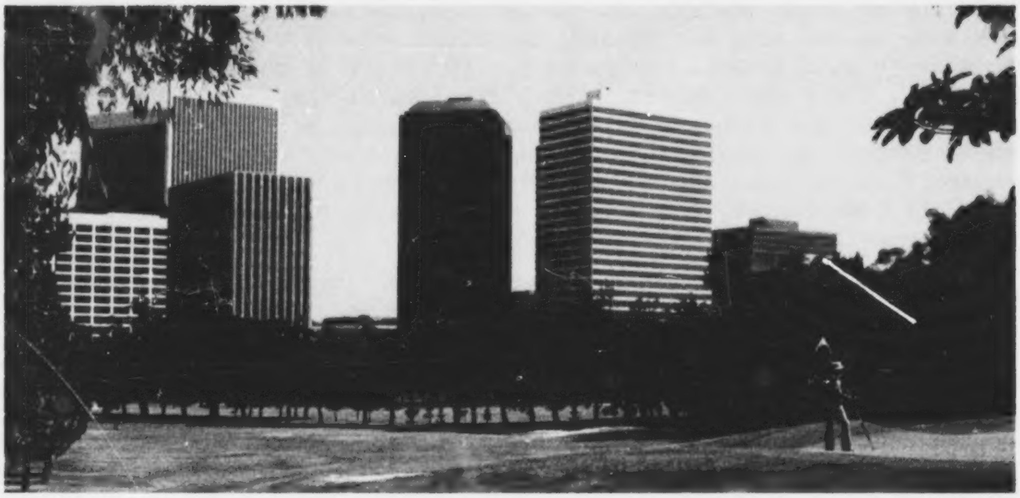

198P—156

Figure II-89. Westwood area of Los Angeles; view is looking east on Wilshire Boulevard.



198P-157

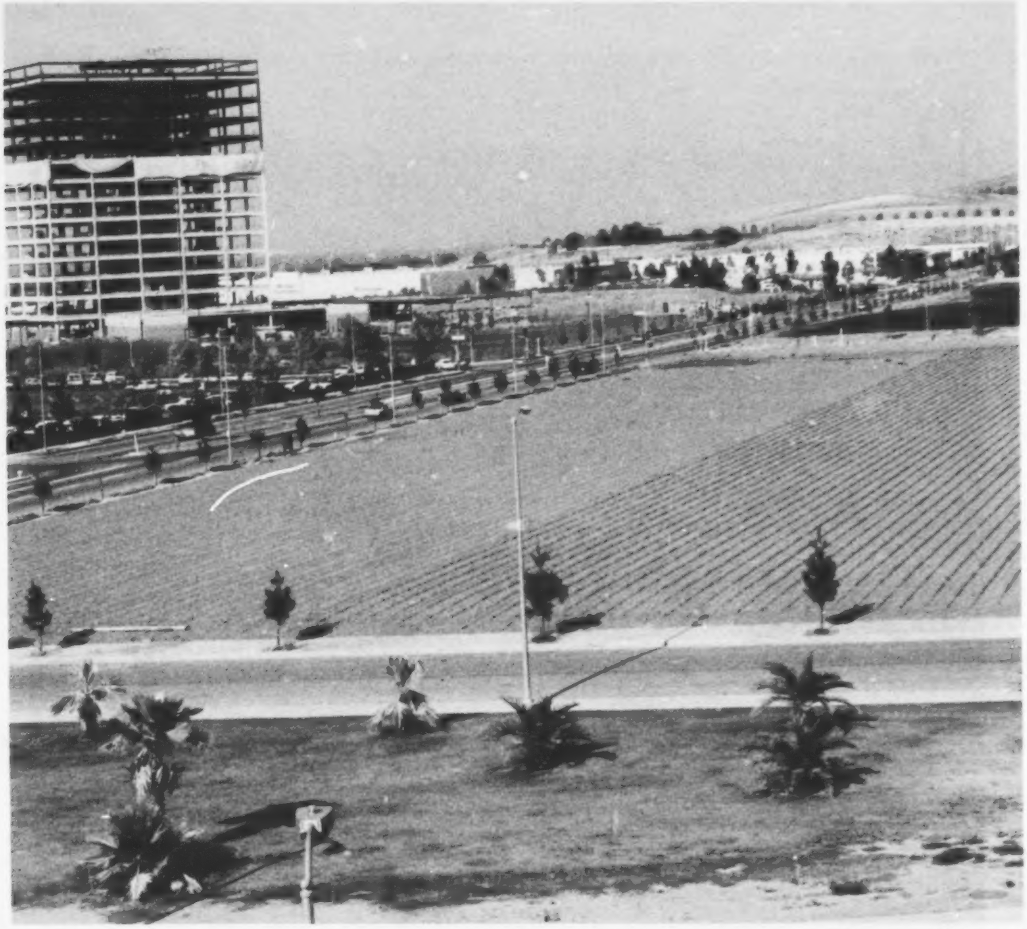
Figure II-90. The new vertical aspect of Los Angeles is depicted here in Century City, created in the early 1960s from the 20th Century Fox Studio property.

intensive development prior to 1990. Figure II-93 shows this area around the Canoga-Woodland Hills center with some of the remaining agricultural activity in the foreground. The agriculture pictured is between the intensive development shown in Figure II-90 and the Ventura Freeway. This site between Topanga Canyon and De Soto Avenue in Western San Fernando Valley is listed as vacant on Figure II-72, the existing land use map.

b. Agricultural Uses. Until the arrival of the Spaniards in California in the late eighteenth century, agriculture was basically a mixture of foraging among wild plant life and sowing a few vegetable crops. The rich land and mild climate combined to produce enough to sustain the numbers and life styles of the native Americans.

With the advent of the Spanish Catholic Missions, and the military presidios built to defend the missions, agriculture was reorganized. To provide a constant food and drink supply for the increased population of colonists, agricultural villages called pueblos were established. In 1781 el Pueblo de Nuestra Señora la Reina de los Angeles (Los Angeles) was founded, and by 1830 enough European colonists from Mexico had relocated to Southern California to make Los Angeles the largest pueblo in California with 1,000 people. Native Americans were pressed into service utilizing imported production techniques for growing grains, grapes, and vegetables, and for pasturing cattle and sheep. This system lasted until the mid 1800s (Fogelson, 1967).

Agricultural production in Los Angeles began another course around the 1840s when independent Mexico encouraged its European Californians to apply for property grants. The land in and around the pueblos was divided up into huge estates (between a hundred and a million acres), known as ranchos, whose owners were called rancheros. In a typical rancho plots were set aside for vineyards, gardens, and fields to provide food and wine for the families living and working there. The largest part of the land was used as grazing lands for longhorn cattle. These agricultural units were virtually self-sustaining, using only a few excess hides and some tallow to buy occasional imported luxuries or utensils. The ranchos

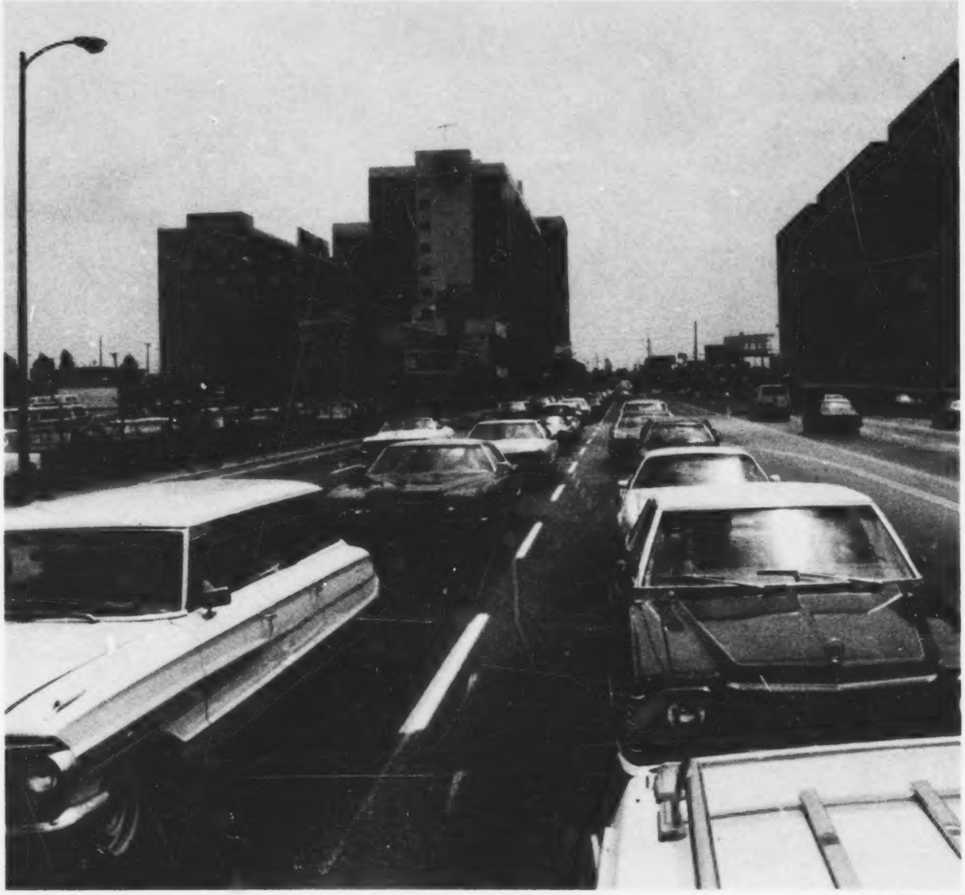


198P—158

Figure II-91. New employment centers in the west end of the San Fernando Valley include this Blue Cross building. Some of the few remaining agricultural uses include the rows of growing corn shown here.

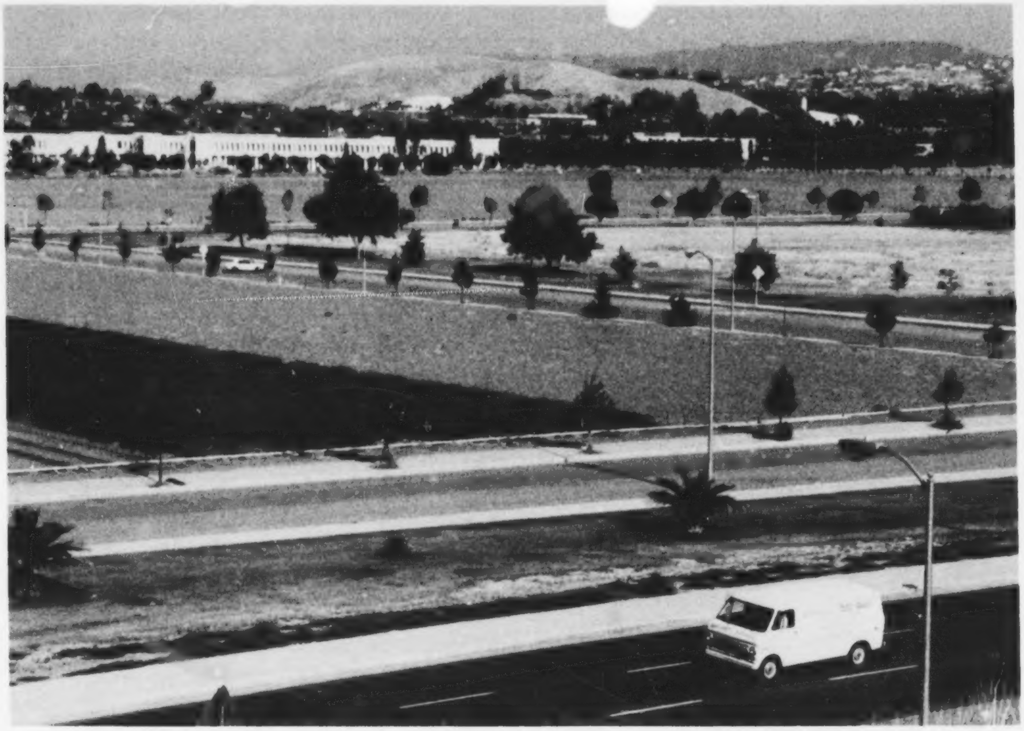
prospered in their isolated location because of sparse population (still only 1,200 by 1840), mild weather, an abundance of land, expanding herds, absence of taxation, and a plentiful supply of cheap labor (Fogelson, 1967).

In 1850, California became one of the United States, and American legal requirements slowly began to change the self-sufficient estates into an agricultural system based on the market. The new government continued an old practice in force in all its other states and territories: taxation. Owners of the ranchos were quickly faced with large tax payments payable in currency, rarely used before. Additionally, the U.S. Government required proof of ownership of all land and established the Land Commission in 1851 to settle the resulting disputes. Native Americans were allowed to go free under the new laws. The result was that the rancheros found



198P–159

Figure II-92. Hotels and offices have grown in and around the Los Angeles International Airport.



198P–160

Figure II-93. Remaining agricultural land near Woodland Hills is shown as vacant on Figure II-72, existing land use, and has all streets and lighting in for the intensive development described in the master plan.

themselves in need of cash with which to pay taxes, litigate their ownership claims, and purchase a labor supply. The necessity for money brought a subsequent need for a market which the rancheros found in Northern California. By the middle of the century, the gold rush around San Francisco and Sacramento had led to a dramatic increase in population. The rancheros accordingly drove their herds north to provide the population with meat and themselves with money.

After 1865, the rush was over, population stabilized, and years of unprecedented drought began. Unable to survive the double loss of market and rain, owners began to divide their land and sell it off, ushering in yet another era of agricultural production. Learning from the mistakes and misfortunes of the previous tenants, the new owners, mostly moneylenders, regarded the land as an economic enterprise required to return a profit. To accomplish this, intensive farming of crops such as grapes, wheat, corn, and fruit was pursued and brought to a growing and elaborate market with connections on the East Coast. The establishment of a bonafide national market and railway system opened up numerous opportunities for merchants, craftsmen, lawyers, bankers, and social organizations. Manufacturers and professionals began to move to Los Angeles from the Midwest and the population nearly doubled between 1870 and 1880, from 5,728 to 11,183. Census figures show that population growth in Los Angeles quadrupled in the 1880s, doubled in the 1890s, tripled in the 1900s, and doubled in both the 1910s and 1920s, until the population reached 1,238,000 by 1930 (Fogelson, 1967). Between 1880 and 1930, an averaged of 45 percent of the population of the Los Angeles region had come from the north central section of the United States, and by the beginning of the twentieth century, a low-density pattern of urban development had been established.

Other factors, besides sheer numbers, contributed to the sparse spread of the City. Through 1910, the growth and electrification of the Los Angeles Railroad Company and the Pacific Electric Railway Company provided access to downtown Los Angeles from points as distant as Santa Monica, Newport Beach, Orange, Covina, and Alpine Tavern. Automobile registration began to climb from 20,000 in 1910 to 800,000 in 1930, necessitating a shift in the responsibility for highway maintenance from the private to the public sector. An adequate supply of water was obtained for continued subdivision with the construction of the Owens Valley Aqueduct in 1913, the development of Mono Basin in the 1930s, and the completion of the Boulder Dam Aqueduct in 1938 (Fogelson, 1967).

The circumstances surrounding agriculture in California in general, and in Los Angeles in particular, contributed to the urban growth which eventually replaced the farm lands. Between 1880 and World War II, many of the agricultural estates, when retained for the production of fruits and vegetables, remained intact as large parcels. The owners were often individual businessmen or large corporations in distant places who hired managers to run the farming business. The knowledge of profit acquisition gained in other professions was extended to the agricultural field. Efficiency and technical advances were brought in to increase production, and promising innovations were experimented with. The large agribusinesses of developing California were in strong contrast to the traditional one-family farms of the East and Midwest. Labor was hired from a pool whose connections with rural land were tenuous. Labor- and implement-sharing, common farming practices elsewhere, were not utilized in the different California conditions. As businesses, the agricultural estates made decisions based on their ability to provide adequate returns on the capital investments made in them. Accordingly, when water and transportation made the outer tracts of Los Angeles land accessible and desirable, and the large number of people created a demand, land owners began to find subdivision of their farms for residential purposes more profitable than cultivation of crops (Gregor, 1957).

The extent to which Los Angeles developed as a low density, wide-area City was effected by other considerations as well. Seismic activity resulted in a series of ordinances prohibiting upward expansion beyond a few stories and necessitating outward extension. A large number of new homes built in the city were one-story, one-family ranch style homes which also contributed to a lateral spread. After World War II, fewer immigrants to the area were rural in past and present orientation than were retired, professional, and urban. The landscape of the Los Angeles area also helped determine future urban and agricultural development. Most of the level and minimal slope lands in Los Angeles were prime agricultural areas if water was available. The same areas, rather than the sharp hillsides and steep mountain reaches, were also natural selections for easy housing construction (Gregor, 1957).

The result was the development of one of the lowest-density (see Table II-30) and fastest growing post-war cities in the U.S. Agricultural development shifted to the north in California's coastal valleys and east into the newly irrigated inland valleys. Vineyards are now abundant in some of California's northern counties. Citrus fruits moved to Ventura and Santa Barbara Counties, walnuts to the Central Valley, and vegetables to San Joaquin and Santa Clara Counties.

Such low-density, large lot development has led to an enormous expanse of land within City boundaries, acres, and to infringement on outlying agricultural land. Figures II-94 through II-97 present the spread of urbanization and concomitant decrease in agricultural land in San Fernando Valley between 1928 and 1958. These figures indicate that in 1928 nonvacant land in the Valley was almost entirely in agricultural use. A few small residential areas were scattered throughout the area, but only the southeast corner had residential, commercial, and industrial uses combined to preclude the possibility of agricultural development. By 1949 the eastern half of the Valley was nearly all residential. The commercial and industrial areas were firmly established along major highways and railroad lines. The western half of the Valley was still very much an agricultural enclave, however. Only six years later, the situation had changed substantially.

Table II-30. Density of major U.S. cities after World War II.

CITY	PERSONS PER SQUARE MILE	
	1950	1970
New York City	25,046	26,345
San Francisco	17,385	15,764
Chicago	17,450	15,126
Boston	16,767	13,936
Detroit	13,249	10,953
Cleveland	12,197	9,893
Los Angeles	4,370	6,073

NOTE: Reductions in densities between 1950 and 1970 are the result of annexations during that period.

Fully three-fourths of the nonvacant Valley was urbanized by this time, and three years later, in 1958, the process of urbanization was nearly complete. Vacant parcels have become very small or retreated to the mountains, agricultural parcels have been pushed to the western and northern fringes for the most part, and industrial development along the railway corridors is very distinct. Table II-31 details this accelerating urbanization.

Figure II-98 indicates the largest remaining parcels of existing and potential agricultural land within Los Angeles and the seven contract cities. Most of these parcels are located along the northern and western boundaries of the City, and in scattered parts of the southern Los Angeles metropolitan area. The contract cities of Beverly Hills, Burbank, Glendale, Culver City, and San Fernando have no agricultural land. The cities of Santa Monica and El Segundo have only small amounts of cropland, 16 acres and 216 acres respectively. Los Angeles, however, has 8,876 acres of such land in 27 of its 35 planning areas. A map of planning areas is given in Figure II-74. The breakdown of agricultural acreage by use and by zoning for each of the 29 planning areas with crop cultivation or zoning is presented in Table II-32.

Of the geographical areas, the San Fernando Valley, as the area most recently developed, still retains the most agricultural acreage, in spite of massive urbanization. Seventy-eight percent of remaining cropland in the City, or 6,891 acres, is in the Valley. The planning areas of Granada Hills-Knollwood, the Verdugo Mountains, Chatsworth-Porter Ranch, and Sunland-Tujunga-Shadow Hills have the largest number of acres under cultivation. Of the planning areas in Western Los Angeles with the remaining 22 percent of farmlands, only Brentwood-Pacific Palisades has substantial agricultural acreage. Acres in agricultural use in Western Los Angeles outnumber acres in agricultural zoning by almost 4 to 1, a reversal of trends in the other geographical areas. Both Central Los Angeles and the Harbor Area have negligible amounts of agricultural land.

Table II-31. Land use within boundary of San Fernando Valley (total area, 123,400 acres).

YEAR	IRRIGATED CROPS		RESIDENTIAL		COMMERCIAL AND INDUSTRIAL		DRY FARM AND NATIVE VEGETATION		MISC., RIPARIAN AND WATER SURFACE	
	ACRES	PERCENT OF TOTAL AREA	ACRES	PERCENT OF TOTAL AREA	ACRES	PERCENT OF TOTAL AREA	ACRES	PERCENT OF TOTAL AREA	ACRES	PERCENT OF TOTAL AREA
1928-29	58,380	47	19,040	15	3,010	2	39,150	32	3,820	3
1930-31	53,610	43	21,480	17	3,940	3	40,550	33	3,820	3
1935-36	53,550	43	27,570	22	6,280	5	31,820	26	4,180	3
1940-41	43,310	35	33,670	27	8,610	7	34,430	28	3,380	3
1945-46	42,710	35	39,760	32	10,950	9	26,450	21	3,530	3
1950-51	34,090	28	46,570	38	12,760	10	26,450	21	3,530	3
1955-56	20,960	17	56,490	46	13,570	11	28,740	23	3,640	3

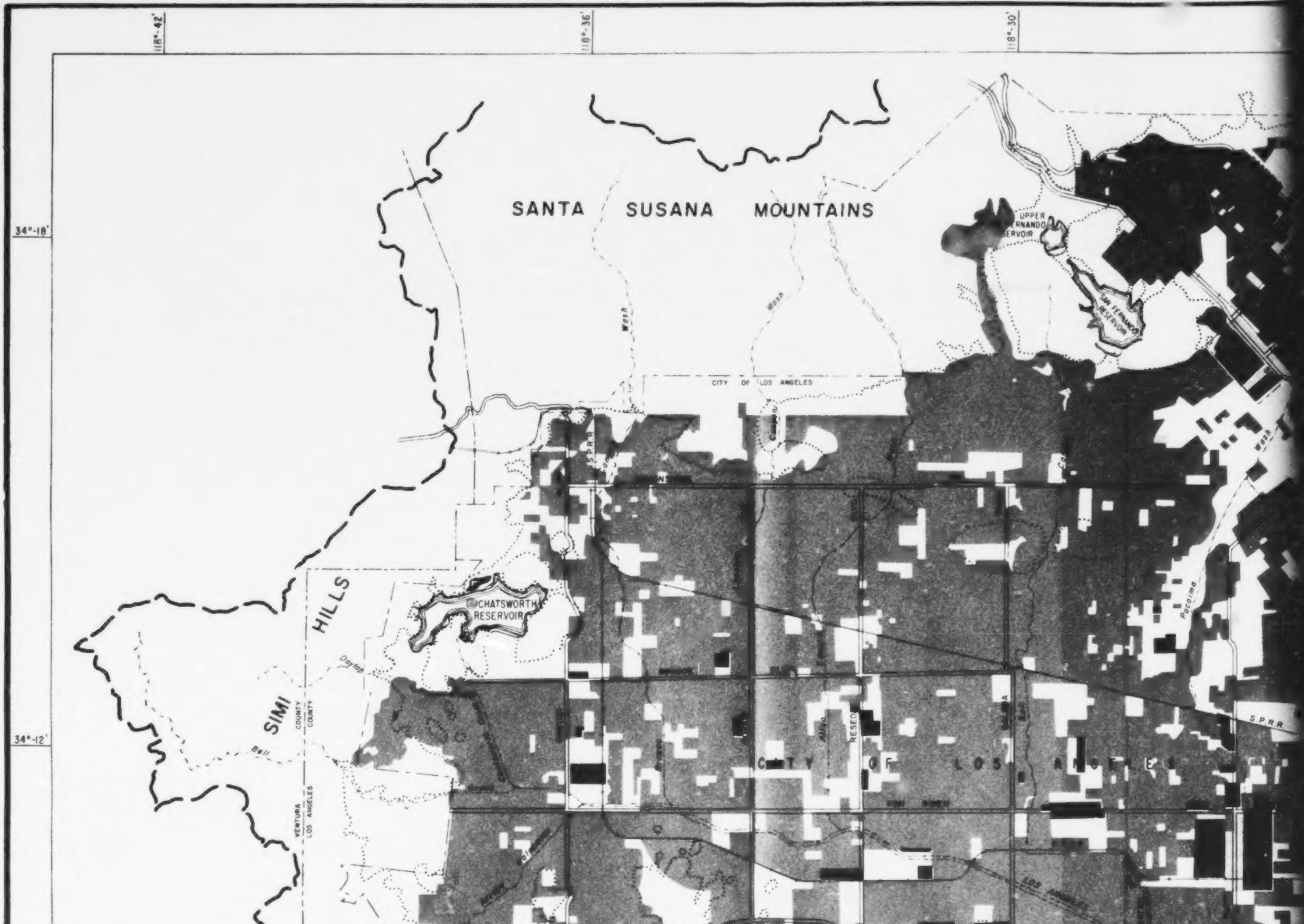
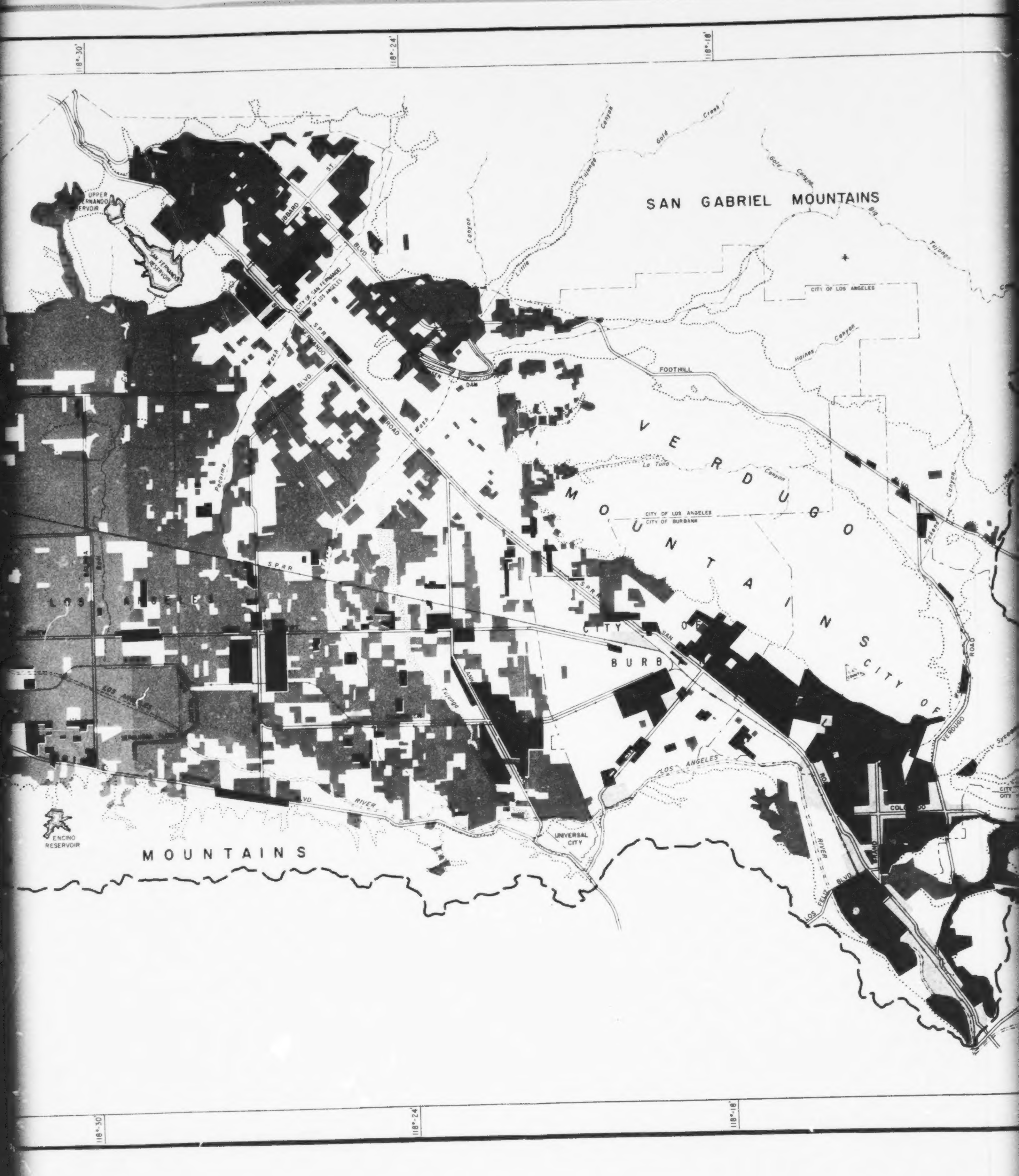
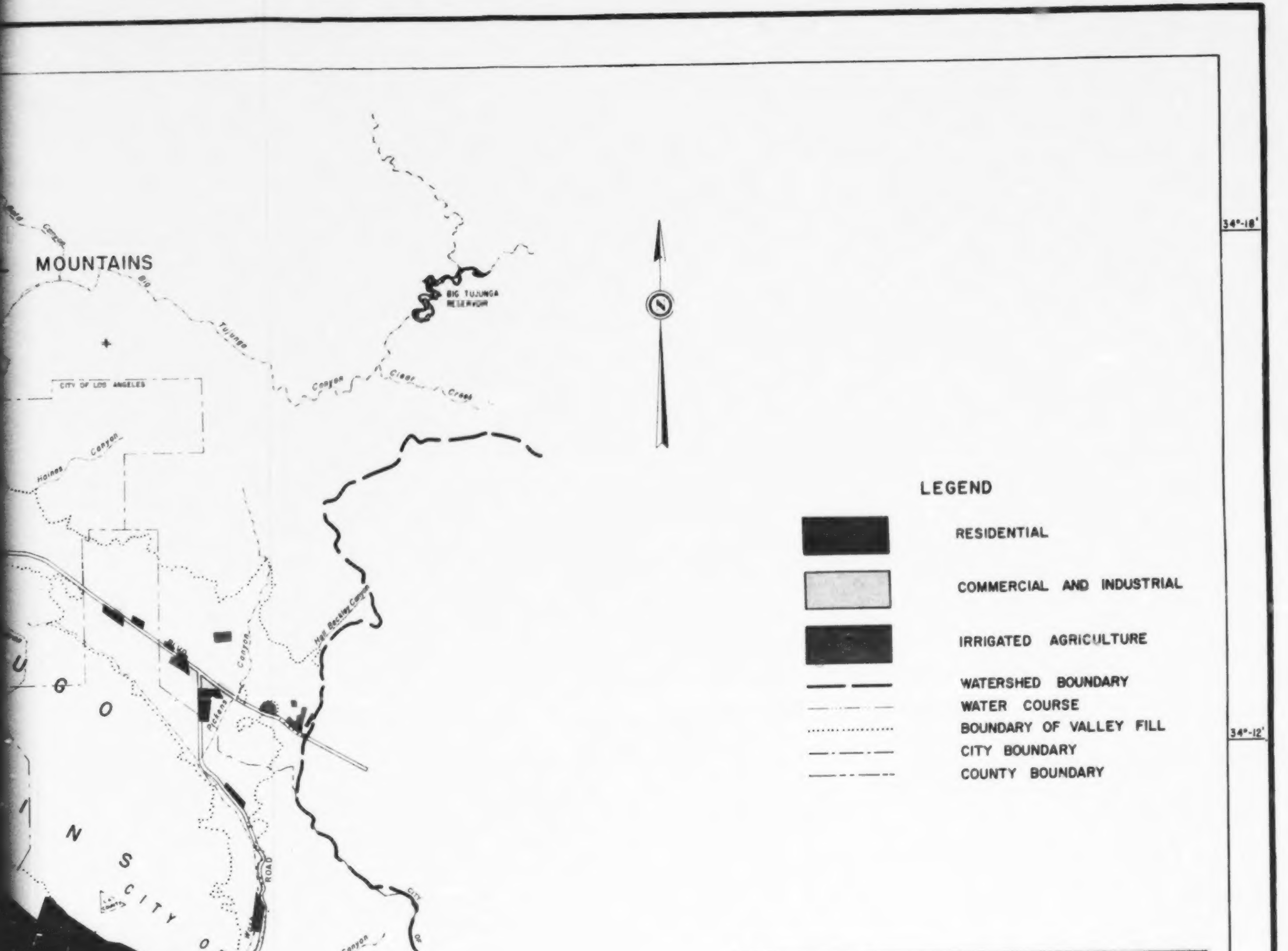

118°-42'
118°-36'
118°-30'
34°-18'
34°-12'
34°-06'
SANTA SUSANA MOUNTAINS
SIMI HILLS
CHATSWORTH RESERVOIR
SAN FERNANDO RESERVOIR
CITY OF LOS ANGELES
VENTURA COUNTY
LOS ANGELES COUNTY
S.P.R.R.
Pacoima Wash
Wash
TOPANGA
ENCINO RESERVOIR
SANTA MONICA MOUNTAINS

Figure II-94. Land use in the San Fernando Valley, 1928.


118°-30'
118°-24'
118°-18'
SAN GABRIEL MOUNTAINS
Gold Creek
Gold Canyon
Big Tujunga
Little Tujunga Canyon
Canyon
CITY OF LOS ANGELES
UPPER SAN FERNANDO RESERVOIR
SAN FERNANDO RESERVOIR
HUBBARD ST
BLVD
CITY OF SAN FERNANDO
CITY OF LOS ANGELES
SAN FERNANDO BLVD
SPRR
HANSEN DAM
FOOTHILL BLVD
Haines Canyon
VERDUGO MOUNTAINS
La Tuna Canyon
CITY OF LOS ANGELES
CITY OF BURBANK
Pacoima Wash
ROAD
Wash
SPRR
LOS ANGELES
CITY OF BURBANK
CITY OF
Tujunga
LOS ANGELES RIVER
BLVD
VERDUGO ROAD
Sycamore
COLORADO
BRAND BLVD
LOS FELIZ BLVD
RIVER
UNIVERSAL CITY
ENCINO RESERVOIR
MOUNTAINS
118°-30'
118°-24'
118°-18'


MOUNTAINS
BIG TUJUNGA RESERVOIR
Big Tujunga Canyon
Clear Creek
Haines Canyon
CITY OF LOS ANGELES
Hall Beckley Canyon
VERDUGO ROAD
CITY OF GLENDALE
Sycamore Canyon
CITY OF PASADENA
GLENDALE
LOS ANGELES
COLORADO BLVD.
BRAND
LOS FELIZ BLVD.
RIVER
FIGUEROA ST.
Arroyo Seco
34°-18'
34°-12'
34°-06'
LEGEND
▇ RESIDENTIAL
▢ COMMERCIAL AND INDUSTRIAL
▇ IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
SCALE
MILES
5000 2500 0 5000 10,000 FEET

SAN FERNANDO VALLEY
LAND USE
1928

4 P.

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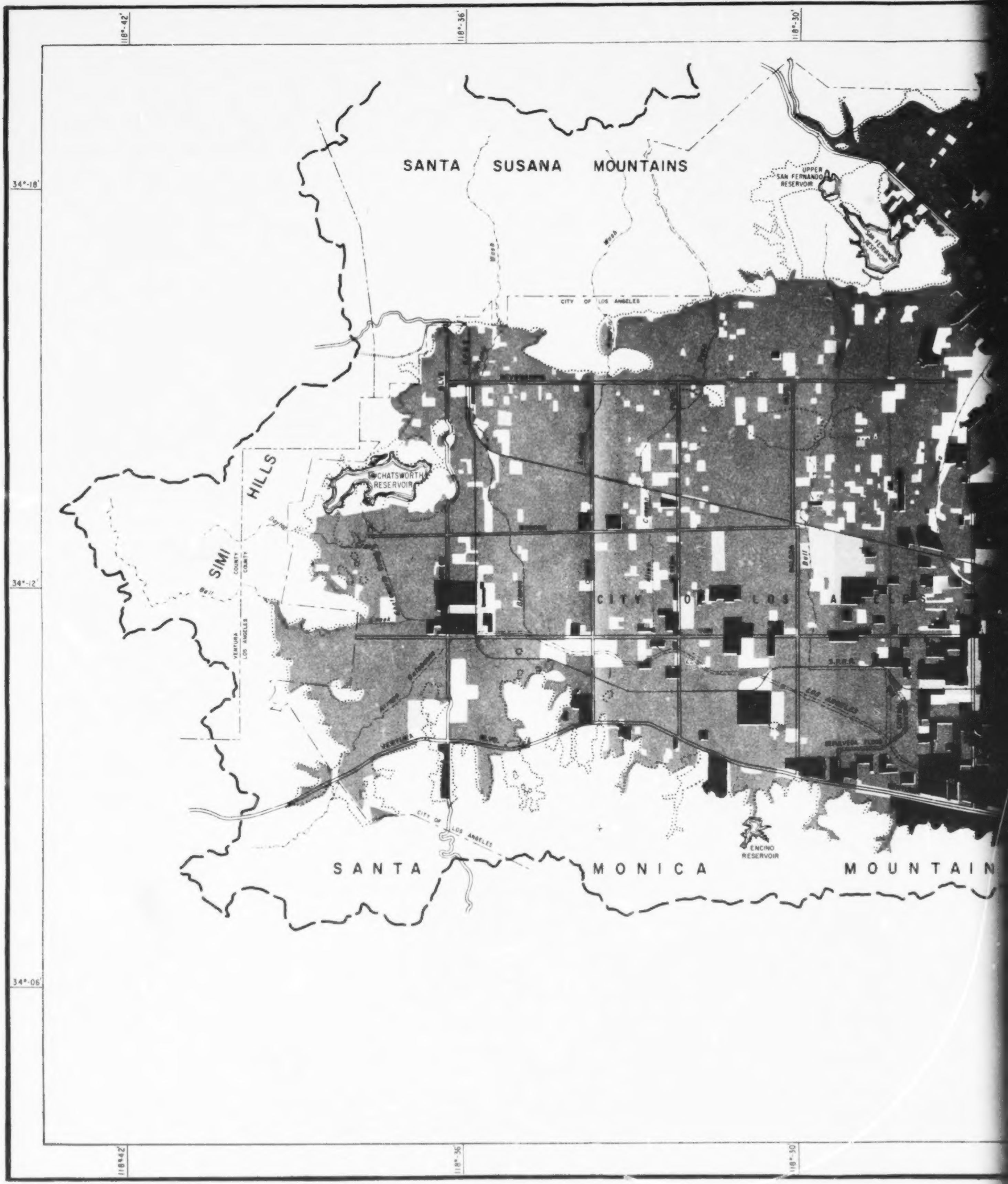
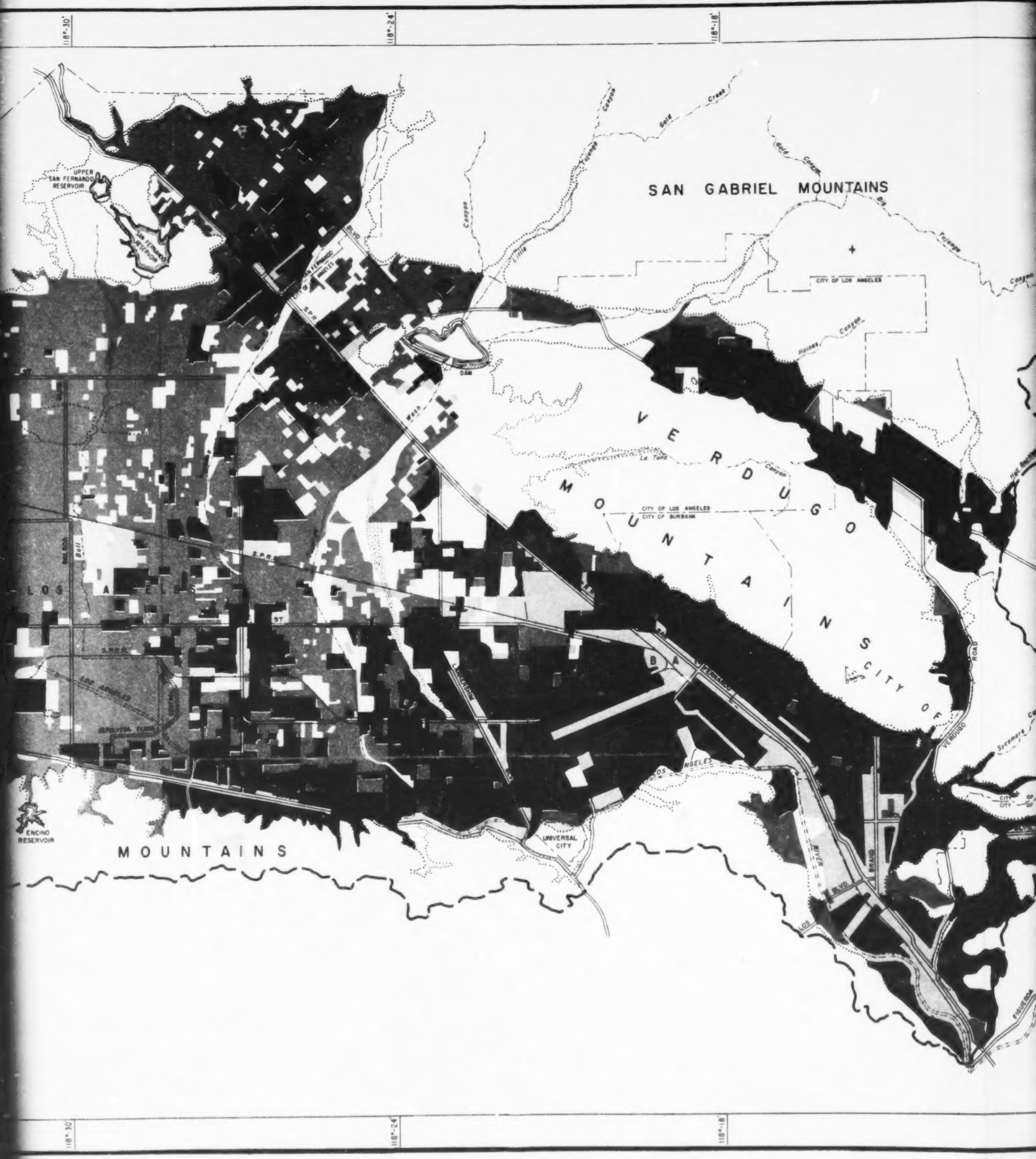
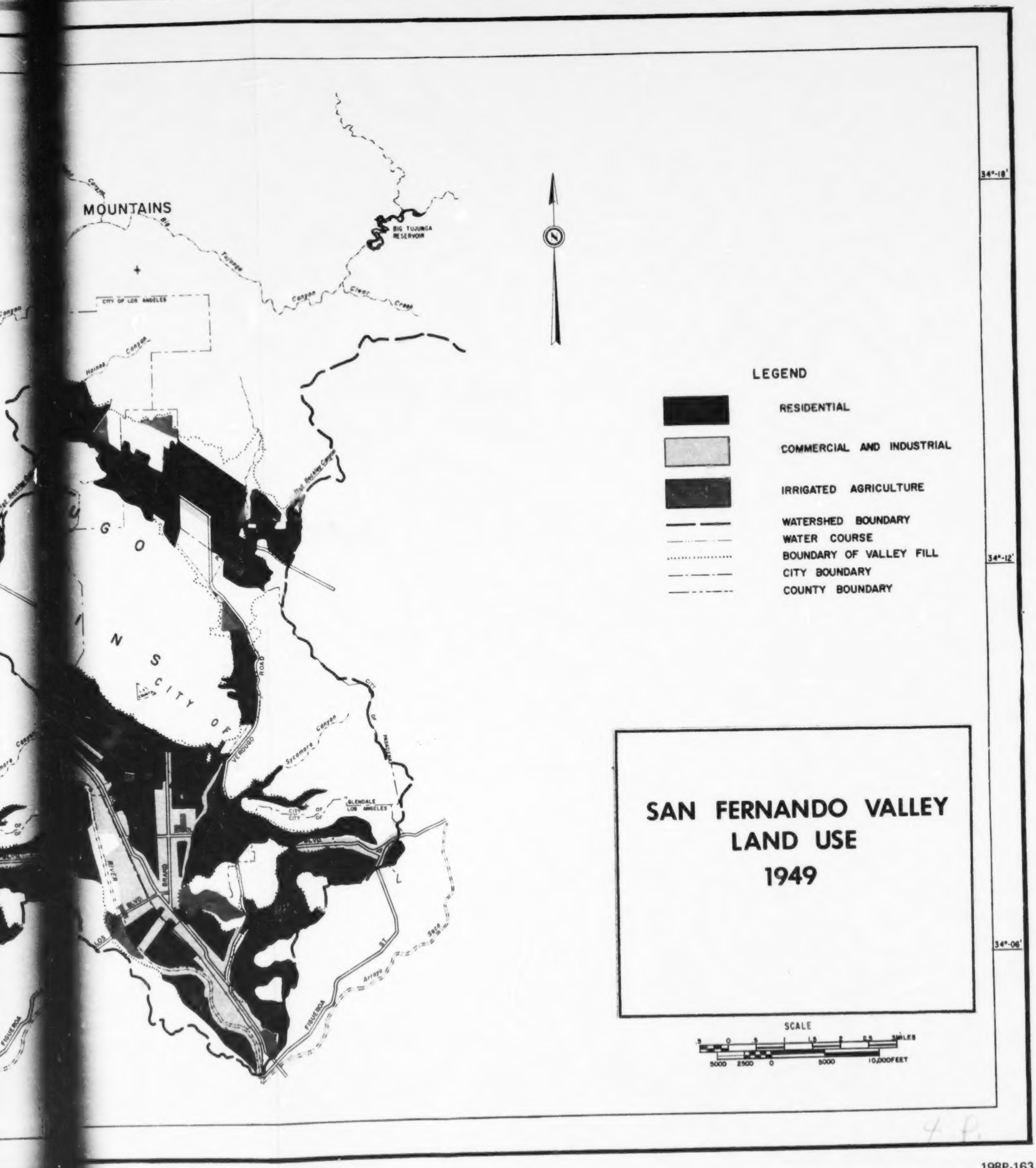

118°-42'
118°-36'
118°-30'
34°-18'
34°-12'
34°-06'
SANTA SUSANA MOUNTAINS
UPPER SAN FERNANDO RESERVOIR
SAN FERNANDO RESERVOIR
Wash
Wash
CITY OF LOS ANGELES
SIMI HILLS
CHATSWORTH RESERVOIR
VENTURA COUNTY
LOS ANGELES COUNTY
Bell
Bell
CITY OF LOS ANGELES
S.P.R.R.
LOS ANGELES
SEPULVEDA FLOOD
VENTURA BLVD.
CITY OF LOS ANGELES
ENCINO RESERVOIR
SANTA MONICA MOUNTAIN
118°42'
118°-36'
118°-30'

Figure II-95. Land use in the San Fernando Valley, 1949.


118°-30'
118°-24'
118°-18'
SAN GABRIEL MOUNTAINS
UPPER SAN FERNANDO RESERVOIR
SAN FERNANDO RESERVOIR
CITY OF SAN FERNANDO
CITY OF LOS ANGELES
BLVD
S.P.R.
DAM
Wash
Little Tujunga Canyon
Gold Creek
Gold Canyon
Big Tujunga Canyon
Haines Canyon
CITY OF LOS ANGELES
VERDUGO MOUNTAINS
La Tuna Canyon
CITY OF LOS ANGELES
CITY OF BURBANK
CITY OF
VERDUGO ROAD
Sycamore Canyon
Hall Beck
LOS ANGELES
ST
Bull
BALBOA
S.P.R.R.
LOS ANGELES
SEPULVEDA FLOOD CONTROL BASIN
LANKERSHIM
BA
SAN FERNANDO
LOS ANGELES
RIVER
BRAND
BLVD
FIGUEROA
ENCINO RESERVOIR
MOUNTAINS
UNIVERSAL CITY
CITY OF
CITY OF
N


SAN FERNANDO VALLEY
LAND USE
1949

MOUNTAINS
BIG TUJUNGA RESERVOIR
Big Tujunga Canyon
Clear Creek
CITY OF LOS ANGELES
Haines Canyon
Dell Beckley Canyon
U G O
N S
CITY OF
VERDUGO ROAD
Sycamore Canyon
CITY OF PASADENA
GLENDALE
LOS ANGELES
CITY OF
BLVD
BRAND
RIVER
LOS
FIGUEROA
ST
Arroyo Seco
34°-18'
34°-12'
34°-06'
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
SCALE
MILES
5000 2500 0 5000 10,000FEET

4 P.

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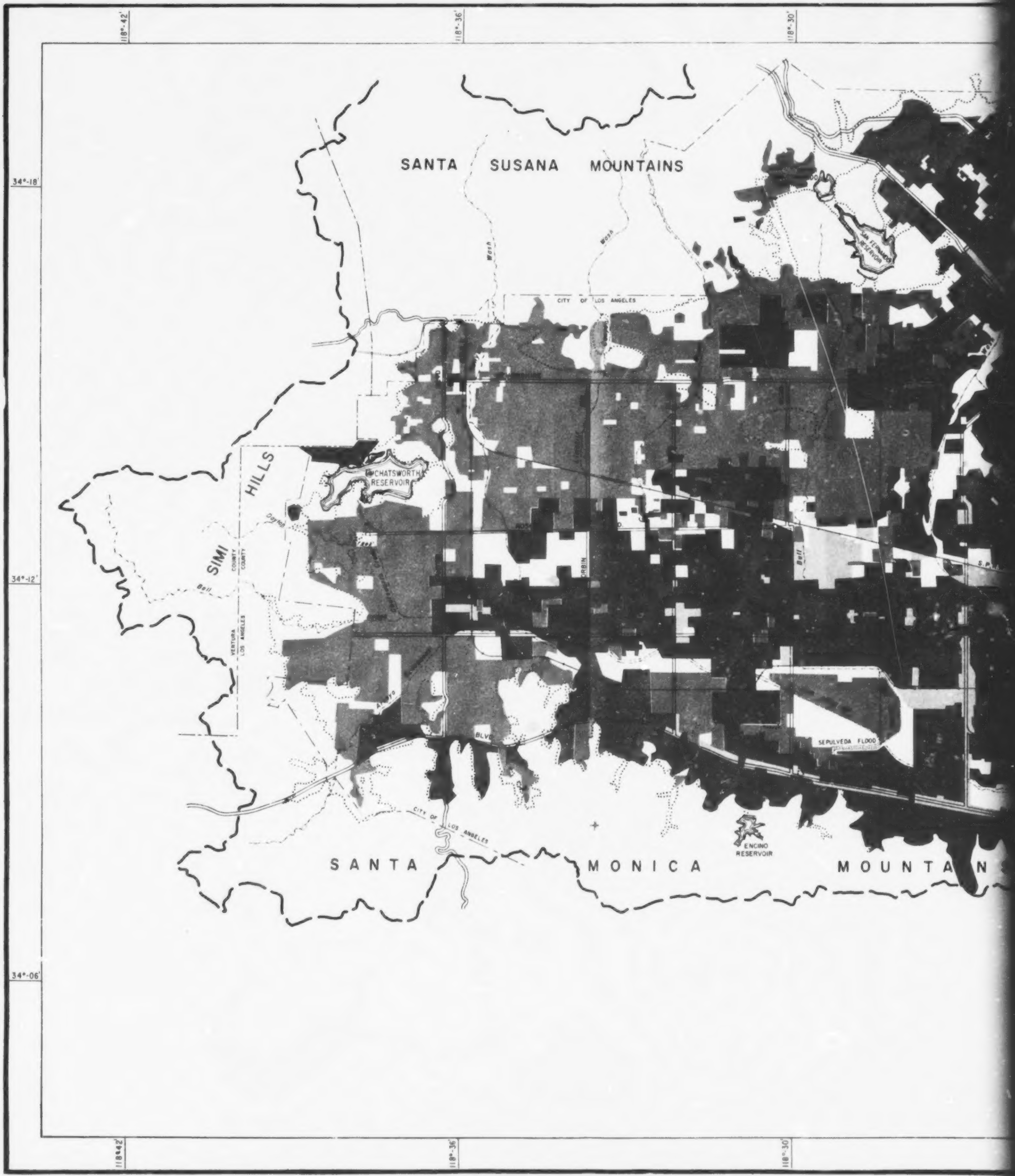
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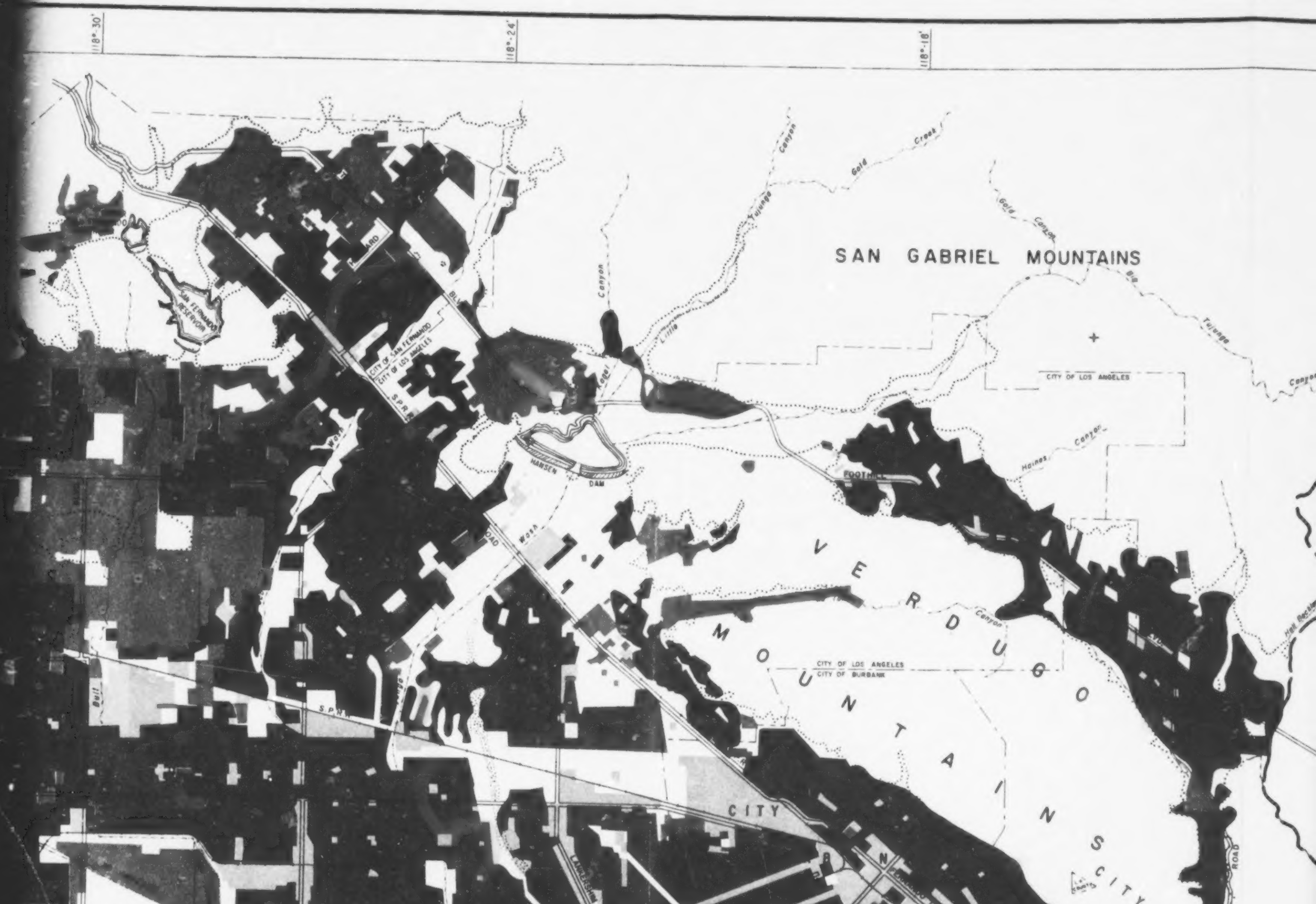
SANTA SUSANA MOUNTAINS
SAN FERNANDO RESERVOIR
Wash
Wash
CITY OF LOS ANGELES
CHATSWORTH RESERVOIR
SIMI HILLS
VENTURA COUNTY
LOS ANGELES COUNTY
Bell
CORBIN
S.P.R.
BLVD
SEPULVEDA FLOOD
CITY OF LOS ANGELES
ENCINO RESERVOIR
SANTA MONICA MOUNTAINS

Figure II-96. Land use in the San Fernando Valley, 1955.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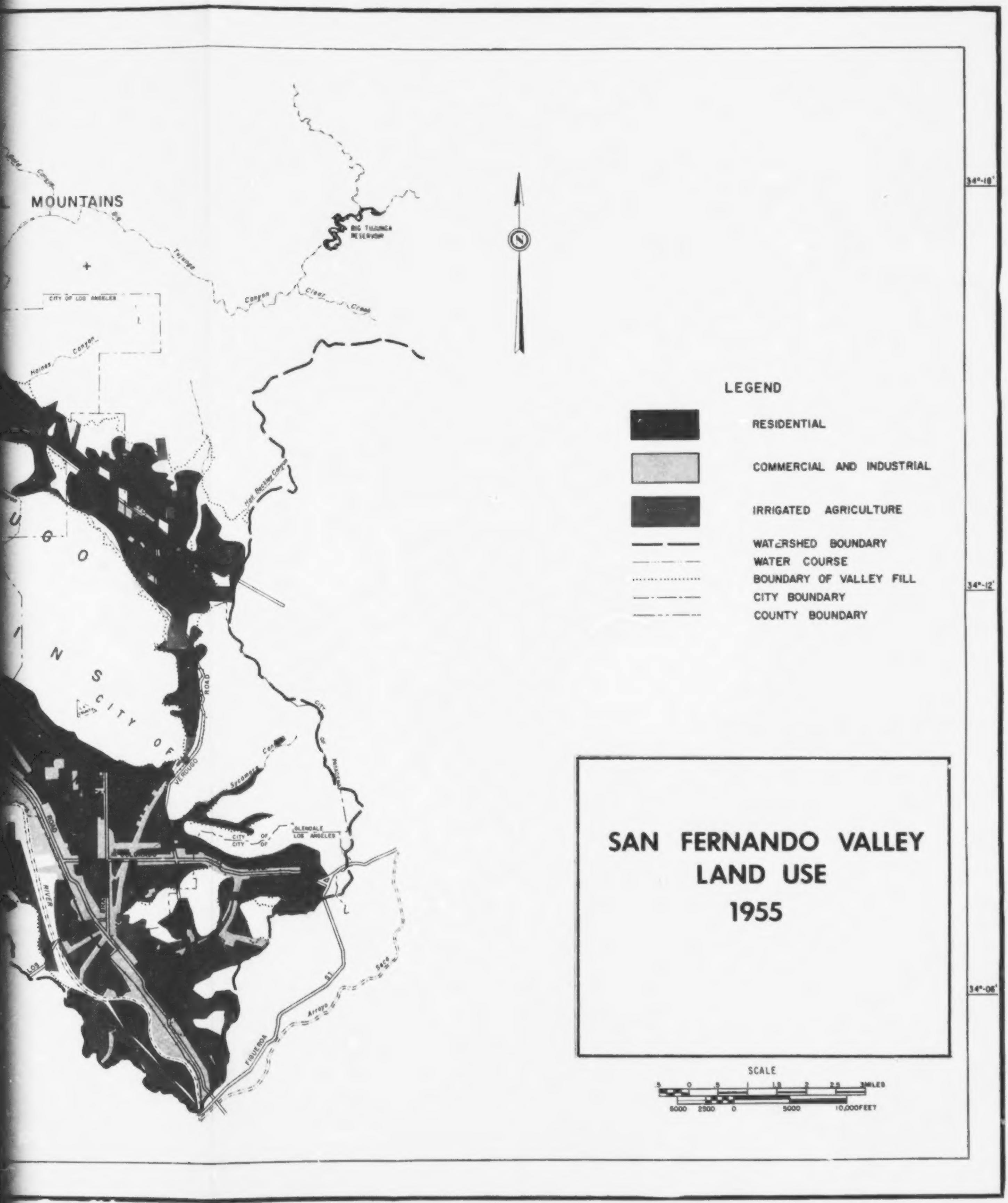
SAN GABRIEL MOUNTAINS
Tujunga Canyon
Gold Creek
Gold Canyon
Big Tujunga Canyon
Little Tujunga Canyon
Haines Canyon
CITY OF LOS ANGELES
SAN FERNANDO RESERVOIR
CITY OF SAN FERNANDO
CITY OF LOS ANGELES
HANSEN DAM
FOOTHILL
Pacoima Wash
VERDUGO MOUNTAINS
CITY OF LOS ANGELES
CITY OF BURBANK
CITY
CITY OF
VERDUGO ROAD
Sycamore Canyon
SEPULVEDA FLOOD
BLVD.
ENCINO RESERVOIR
MOUNTAINS
UNIVERSAL CITY
LOS ANGELES RIVER
FIGUEROA


MOUNTAINS
U G O
N S
CITY OF
CITY OF LOS ANGELES
Haines Canyon
Tujunga Canyon
Clear Creek
BIG TUJUNGA RESERVOIR
Hall Beckley Canyon
Sycamore Canyon
VERDUGO ROAD
CITY OF GLENDALE
CITY OF LOS ANGELES
CITY OF PASADENA
RIVER
ROAD
LOS
FIGUEROA ST
Arroyo Seco
34°-18'
34°-12'
34°-06'
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
SCALE
.5 0 .5 1 1.5 2 2.5 3 MILES
5000 2500 0 5000 10,000 FEET

SAN FERNANDO VALLEY
LAND USE
1955

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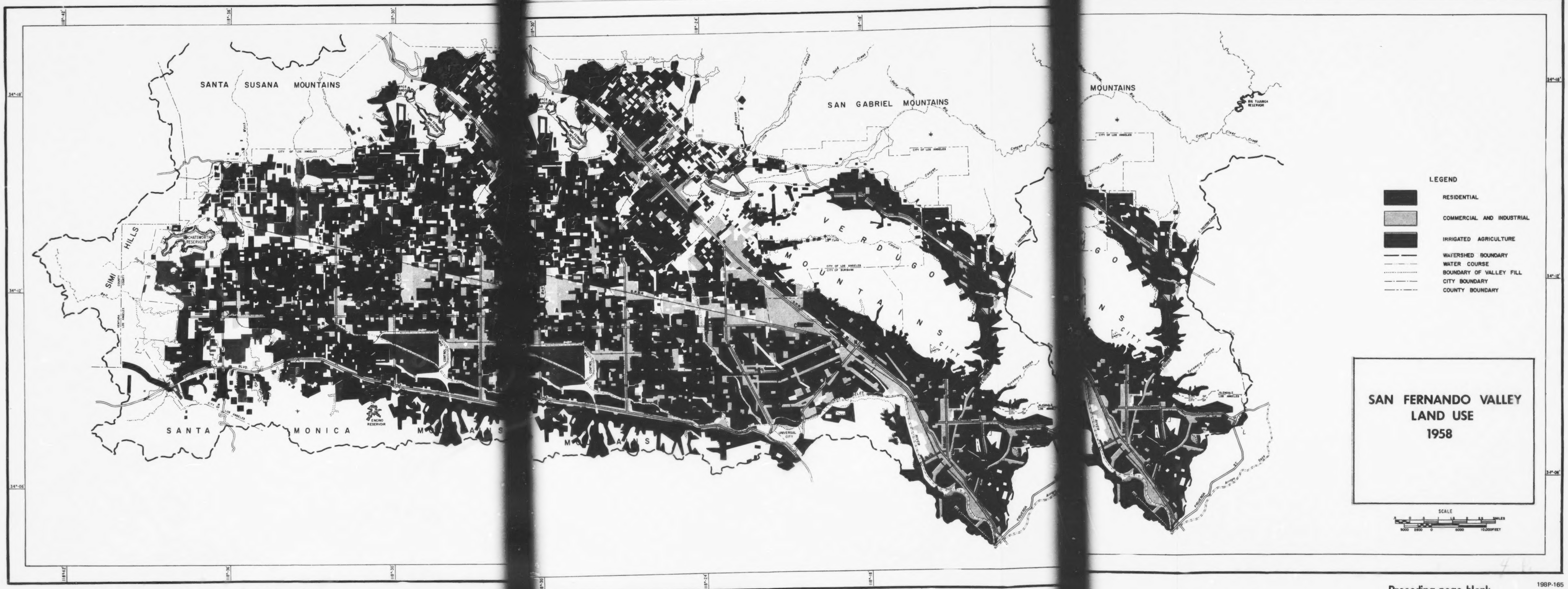
SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
MOUNTAINS
BIG TUJUNGA RESERVOIR
SIMI HILLS
CHATSWORTH RESERVOIR
CITY OF LOS ANGELES
CITY OF BURBANK
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
ENCINO RESERVOIR
UNIVERSAL CITY
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
SAN FERNANDO VALLEY
LAND USE
1958
SCALE
MILES
FEET
118°-42'
118°-36'
118°-30'
118°-24'
118°-18'
34°-18'
34°-12'
34°-06'

Figure II-97. Land use in the San Fernando Valley, 1958.

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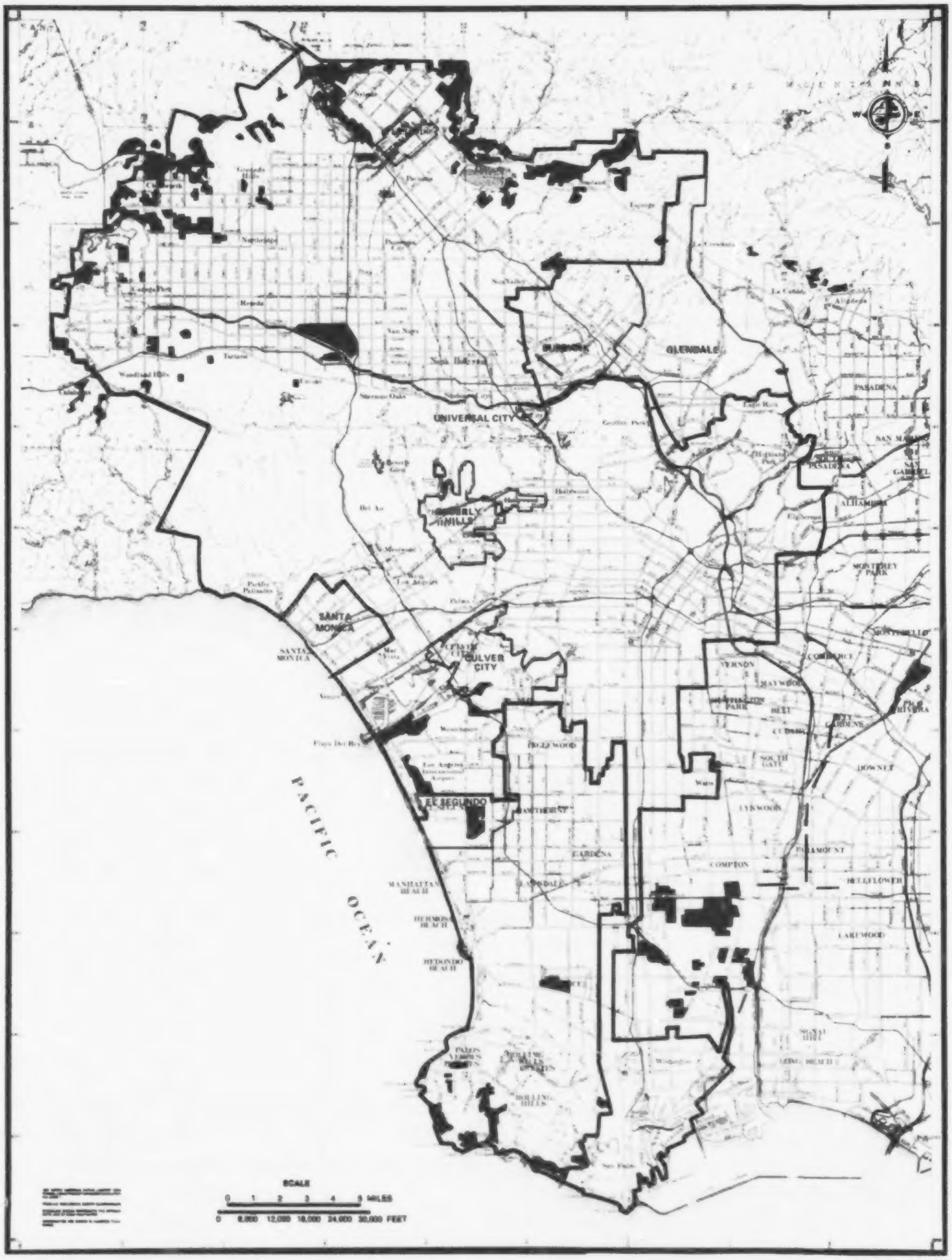
GLENDALE
BURBANK
PASADENA
UNIVERSAL CITY
BEVERLY HILLS
ALHAMBRA
MONTEREY PARK
MONTEBELLO
SANTA MONICA
CULVER CITY
VERNON
EL SEGUNDO
INGLEWOOD
HAWTHORNE
GARDENA
SOUTH GATE
LYNWOOD
DOWNEY
COMPTON
BELLFLOWER
LAKEWOOD
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
ROLLING HILLS
PACIFIC OCEAN
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET

198P–166

Figure II-98. Agricultural land in the City of Los Angeles and adjacent communities.

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Table II-32. Agricultural land use by planning area and geographical area in the City of Los Angeles, 1976.

GEOGRAPHICAL AREA Planning Area	LAND USE (NO. OF ACRES)
SAN FERNANDO VALLEY	6,890.8
Sylmar	512.6
Verdugo Mountains	2,269.5
Chatsworth-Porter Ranch	858.8
Canoga Park-Winnetka-Woodland Hills	260.6
Encino-Tarzana	19
Granada Hills-Knollwood-Mission Hills-Sepulveda	1,730.6
Panorama City	4.6
North Hollywood	42.3
Northridge	6.7
Pacoima-Arleta-Lake View Terrace	327.6
Sherman Oaks-Studio City-Toluca Lake	4.1
Sunland-Tujunga-Shadow Hills	826.7
Sun Valley	27.7
WESTERN LOS ANGELES	1,968.8
Brentwood-Pacific Palisades	1,956.4
Palms-Mar Vista	2
Venice	10.4
CENTRAL LOS ANGELES	7.8
Hollywood	0.8
Northeast Los Angeles	5.1
Silverlake-Echo Park	0.1
South Central	1.1
Southeast Los Angeles	0.1
Baldwin Hills-Lermert-West Adams	0.6
HARBOR AREA	9.1
Torrance-Gardena Strip	1.5
San Pedro	7.5
Wilmington-Harbor City	0.1
TOTAL LOS ANGELES	8,876.5

Table II-33 details the specific uses of agricultural land in the San Fernando Valley and in the entire City of Los Angeles. The largest acreage is devoted to nonirrigated uses in the San Fernando Valley. Cultivation of croplands covers a minimal 163 acres, while the largest uses are open space pastures and deserts or unspecified uses.

All agriculturally used land represents open space presently providing buffers between various urban uses and is potentially subject to development. The Los Angeles General Plan does not mention agricultural uses or preservation of these areas. The concept of preserving and acquiring open space is included in the General Plan, but mainly in the context of recreational uses such as parks and playgrounds. None of the 35 community plans includes designations for agricultural land use or zoning. Land currently in agricultural use is slated for development by 1990 in each of the 35 communities.

Table II-33. Type of agricultural use in the City of Los Angeles and the San Fernando Valley.

TYPE OF USE		SAN FERNANDO VALLEY	CITY OF LOS ANGELES
IRRIGATED FARM	Unspecified	338.6	349
	Fruits & Nuts	107.4	107.4
	Truck Crops	0	0.1
	Field Crops	8.2	8.9
	Pasture	251.4	251.4
	Dairies	18.5	28.9
	Poultry	82.1	83.6
	Feed Lots	0.5	0.5
	TOTAL	806.7	829.8
DRY FARM	Unspecified	1,501.1	3,457.6
	Fruit & Nuts	4.7	4.7
	Vineyards	0	0.2
	Field Crops	41.6	41.6
	Pasture	710.6	710.6
	Timber-Pine	40	40
	Desert	2,692.1	2,692.1
	Waste	1,094	1,099.7
	TOTAL	6,084.1	8,046.5
TOTALS		6,890.8	8,876.3

2. LAND USE PLANNING

Existing economic and employment factors, the need for improved transportation, population projections, and community needs have been taken into consideration by the City Department of Planning in its projections of future land use for the City's commercial, industrial, institutional and residential requirements. Section 96.5 (1) of the City Charter identifies the need for a Citywide General Plan:

> Purpose: The General Plan shall serve as a basic and continuous reference in (a) planning for the development of the City, (b) developing, correlating and coordinating official regulations, controls programs and services, and (c) attaining coordination of planning and administration of all agencies of the city government, other governmental bodies and private organizations and individuals involved in the development of the City.

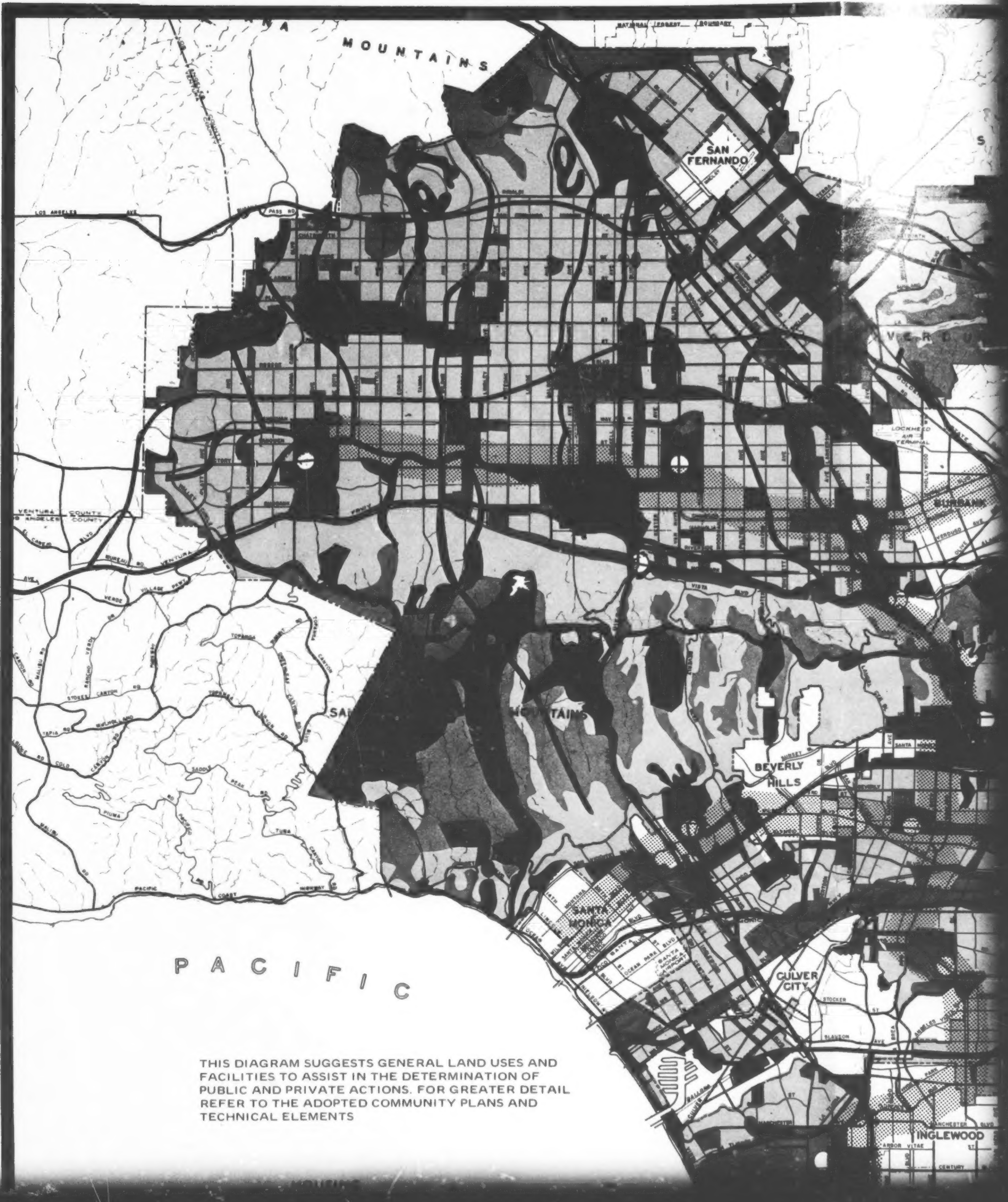
In recent years, the statutes of the State of California have been amended in ways which give the "Master Plan" or "General Plan" legal effects that are more consequential than in any other state. The General Plan must contain land use, housing, conservation, circulation, open space, seismic safety, noise, and scenic highway elements. Optional elements include recreation and public services. The City of Los Angeles as a Charter City is not required by law to have zoning and the General Plan in conformity; nevertheless, the City Charter does require conformity unless the City Council and/or the Planning Commission justifies inconsistency between the two.

The Concept General Plan sets forth an overview of the city planning goals and provides the 35 Community Planning Councils with guidelines for their local planning efforts. Figure II-99 illustrates the principle and intent of the objectives, policies and programs of the Citywide plan. Specific details regarding land use, density, transportation, public facilities and technical elements require review of Community Plans that have been adopted.

This informational diagram for the City in the General Plan shows major physical features at the Citywide level and indicates open space land of citywide and regional significance. Lands classified as open space are those publicly and privately owned lands which are devoted to open space use and designated as open space on the Open Space Plan. This diagram is not an official zone map nor does it imply any particular zone or land use. The transit corridors are those adopted by the Southern California Rapid Transit District Board. Nevertheless, it is useful to compare existing land use (Figure II-72) with the Concept General Plan (Figure II-99).

In April, 1974, the Los Angeles City Council adopted the Concept for the General Plan and the Citywide Plan given in Figure II-99.

A


MOUNTAINS
NATIONAL FOREST BOUNDARY
SAN FERNANDO
LOS ANGELES AVE
VENTURA COUNTY
LOS ANGELES COUNTY
VENTURA BLVD
LOCKHEED AIR TERMINAL
BURBANK
VERDUGO
SA
MOUNTAINS
BEVERLY HILLS
SANTA MONICA
SANTA MONICA AIRPORT
CULVER CITY
PACIFIC
INGLEWOOD
MANCHESTER BLVD
PACIFIC COAST HIGHWAY
TOPANGA CANYON
SLAUSON AVE
ARBOR VITAE
CENTURY

THIS DIAGRAM SUGGESTS GENERAL LAND USES AND FACILITIES TO ASSIST IN THE DETERMINATION OF PUBLIC AND PRIVATE ACTIONS. FOR GREATER DETAIL REFER TO THE ADOPTED COMMUNITY PLANS AND TECHNICAL ELEMENTS

B

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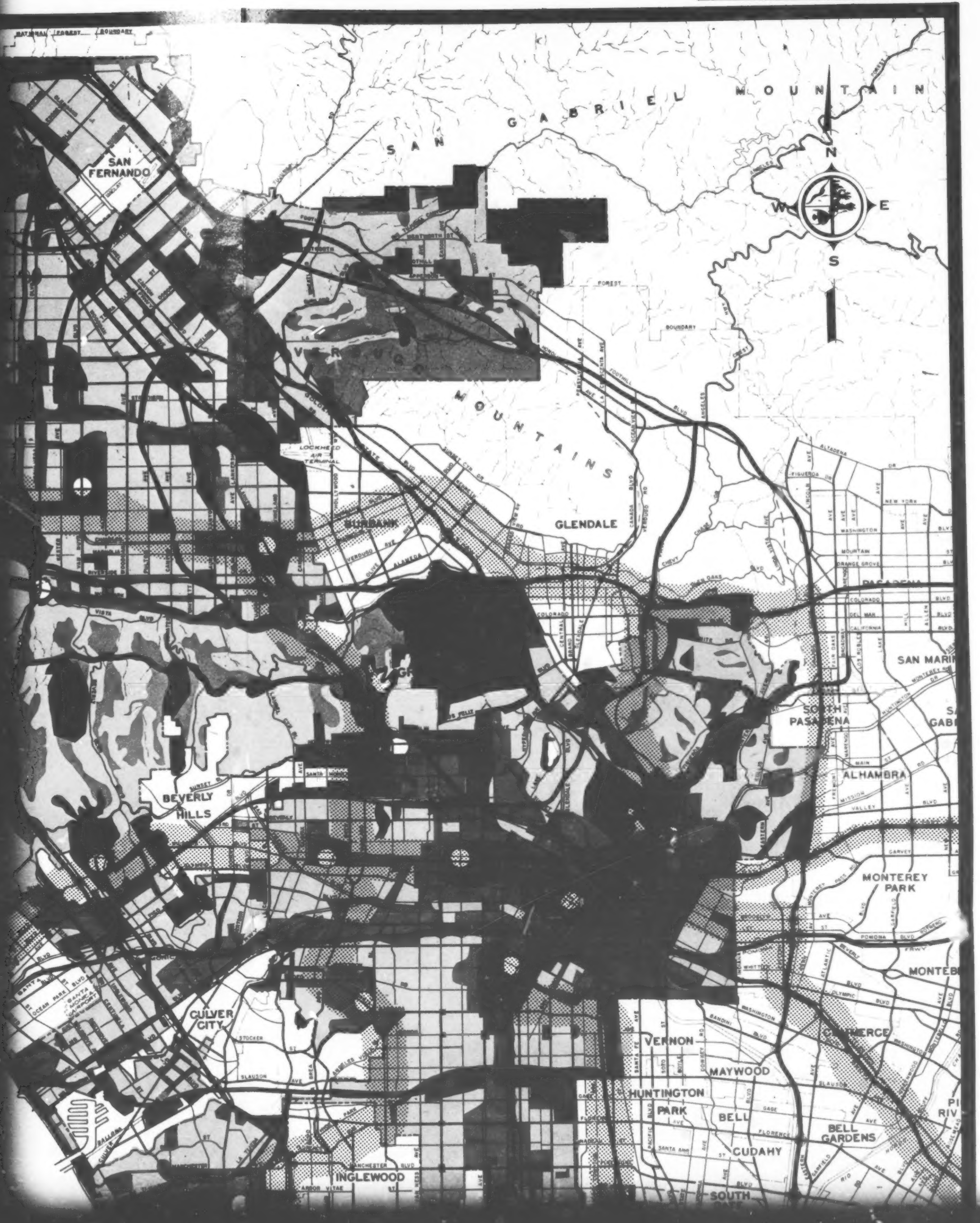

NATIONAL FOREST BOUNDARY
SAN GABRIEL MOUNTAIN
N
E
S
W
FOREST BOUNDARY
SAN FERNANDO
VERDUGO
MOUNTAINS
LOCKHEED AIR TERMINAL
BURBANK
GLENDALE
PASADENA
SAN MARI
SOUTH PASADENA
ALHAMBRA
BEVERLY HILLS
MONTEREY PARK
MONTEB
CULVER CITY
VERNON
COMMERCE
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY
INGLEWOOD
SOUTH

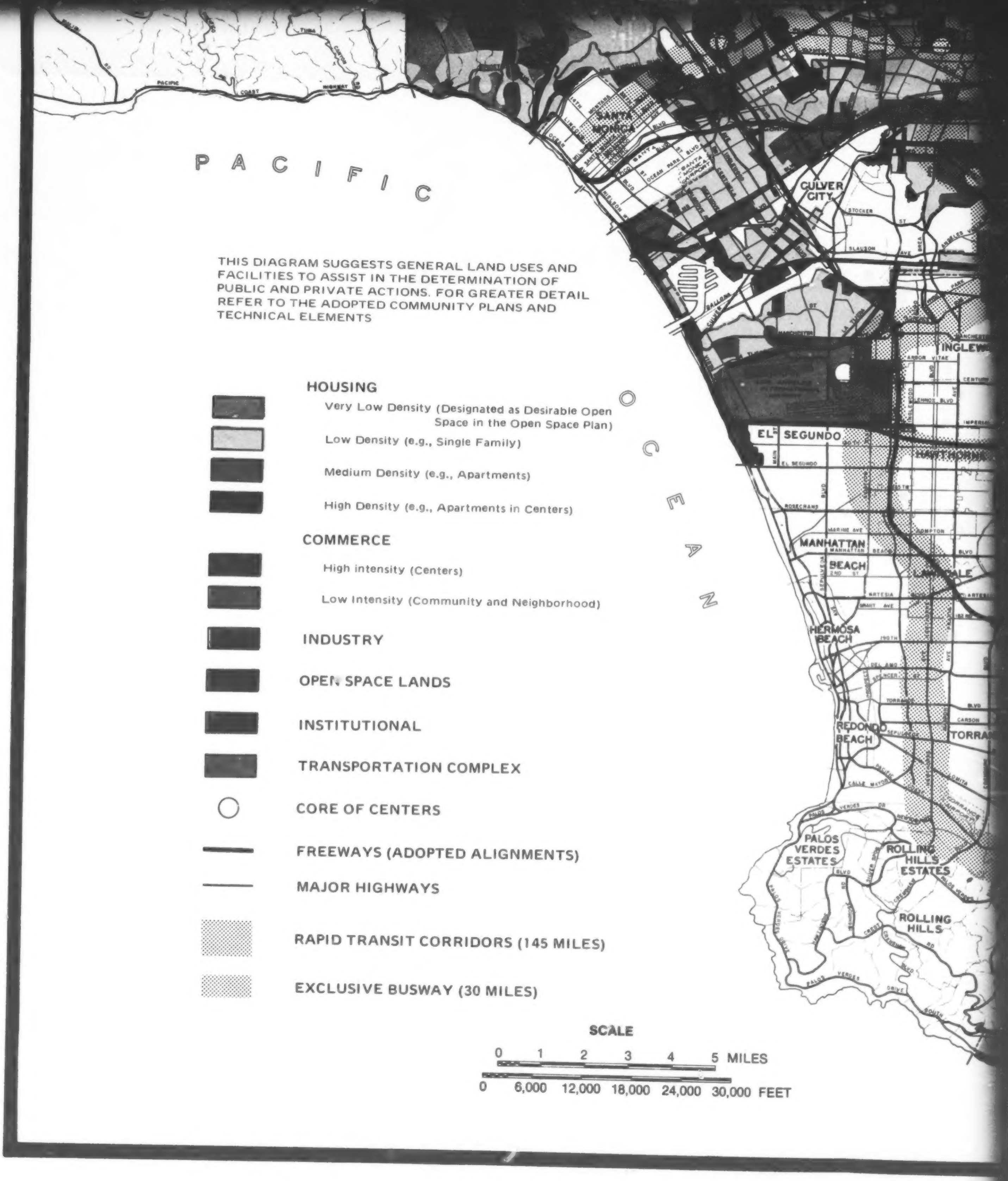
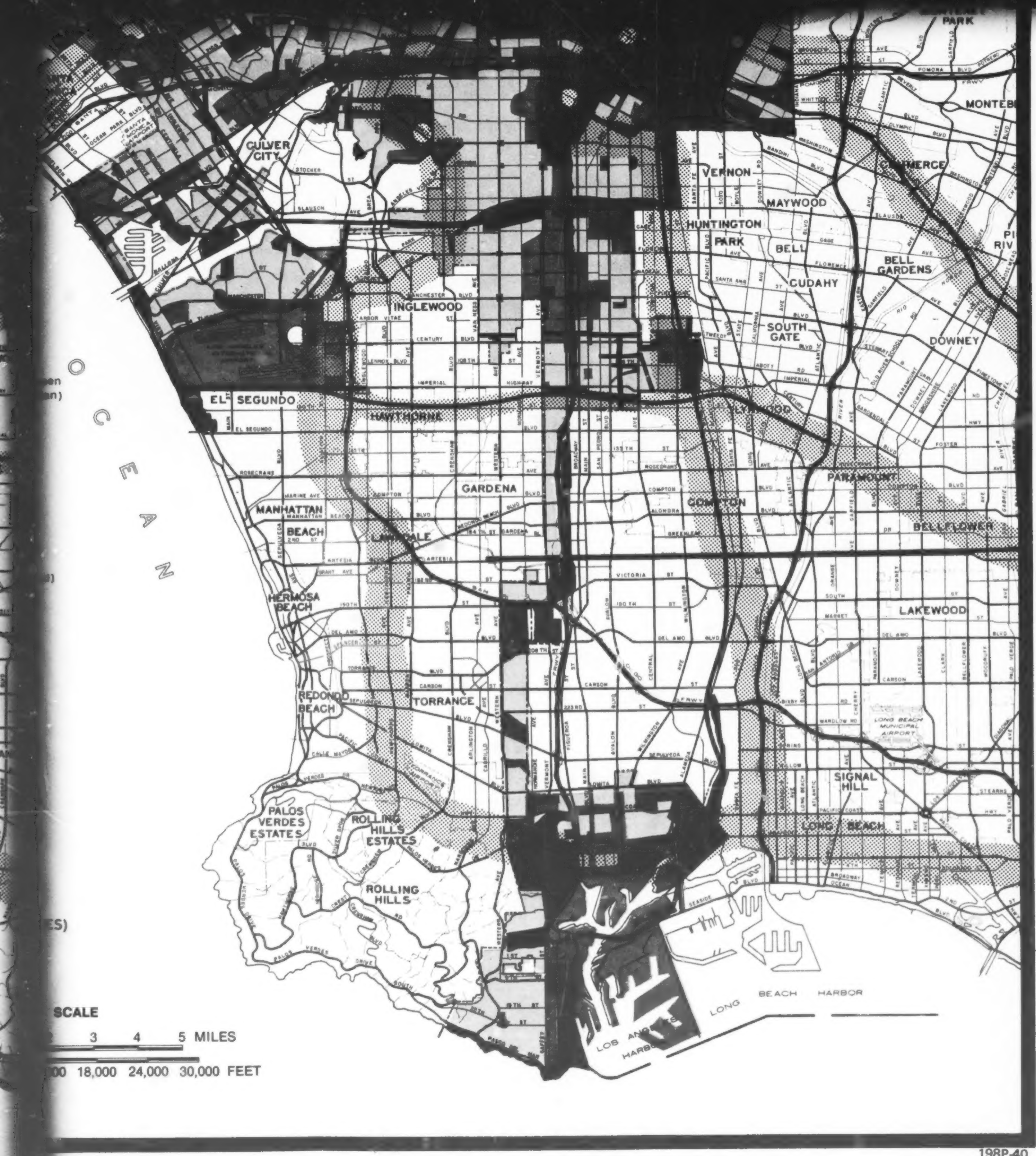

PACIFIC OCEAN
THIS DIAGRAM SUGGESTS GENERAL LAND USES AND FACILITIES TO ASSIST IN THE DETERMINATION OF PUBLIC AND PRIVATE ACTIONS. FOR GREATER DETAIL REFER TO THE ADOPTED COMMUNITY PLANS AND TECHNICAL ELEMENTS
HOUSING
Very Low Density (Designated as Desirable Open Space in the Open Space Plan)
Low Density (e.g., Single Family)
Medium Density (e.g., Apartments)
High Density (e.g., Apartments in Centers)
COMMERCE
High intensity (Centers)
Low Intensity (Community and Neighborhood)
INDUSTRY
OPEN SPACE LANDS
INSTITUTIONAL
TRANSPORTATION COMPLEX
CORE OF CENTERS
FREEWAYS (ADOPTED ALIGNMENTS)
MAJOR HIGHWAYS
RAPID TRANSIT CORRIDORS (145 MILES)
EXCLUSIVE BUSWAY (30 MILES)
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
PACIFIC COAST HIGHWAY
SANTA MONICA
CULVER CITY
INGLEWOOD
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS

Figure II-99. Concept General Plan Guidelines.


PARK
MONTEB
CULVER CITY
VERNON
COMMERCE
MAYWOOD
HUNTINGTON PARK
BELL
PI RIV
BELL GARDENS
CUDAHY
INGLEWOOD
SOUTH GATE
DOWNEY
O C E A N
EL SEGUNDO
HAWTHORNE
LYNWOOD
PARAMOUNT
GARDENA
COMPTON
MANHATTAN BEACH
BELLFLOWER
LAWNDALE
HERMOSA BEACH
LAKEWOOD
REDONDO BEACH
TORRANCE
LONG BEACH MUNICIPAL AIRPORT
SIGNAL HILL
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
LONG BEACH
ROLLING HILLS
LONG BEACH HARBOR
LOS ANGELES HARBOR
SCALE
3
4
5 MILES
18,000
24,000
30,000 FEET

198P-40

ines.

The long-range "Concept" portion of the General Plan serves as a generalized framework that includes broad policies for such matters as housing, land use, commerce, and transportation. The Citywide Plan is directed to the intermediate range, the next 20 years, and as such represents the initial stage in the achievement of the city envisioned in the Concept.

To evaluate the effects of the Facilities Plan, the existing land use is to be compared with the future land use. The General Plan, as a goal, identifies land use patterns for which the City is committed to provide wastewater treatment. The Facilities Plan thus should be consistent with the General Plan Concept. This Concept is characterized by centers having a high intensity of development and activity and low density suburban areas. Centers will include commercial, residential, appropriate industrial, recreational, cultural, educational, and other public facilities. Suburbs will be predominantly residential in character, but will include local business, public service facilities, schools, and parks. Centers of residences and businesses served by a mass rapid transit system form a major component of the Plan. Development of Centers depends primarily upon a restructuring of the City as new facilities are constructed and obsolete ones replaced.

The Concept General Plan serves as a guideline for the 35 planning areas composed of 70 communities tributary to the Los Angeles Wastewater Facilities. Only about one-half of the community plans and technical elements have been adopted as of mid-1976. The City centers displayed in Figure II-99 and a proposed transportation network to alleviate the problems identified above are overlaid on this Concept Plan. A comparison of Figure II-99, the future plan, with Figure II-72, the existing land use, yields several striking observations.

1. The established goal of a major curtailment of strip commercial and a concentration of commercial activities in the City Center. This goal is evident throughout the City, but is most noticeable in the San Fernando Valley. The process for this conversion is not spelled out, but such a concentration of commercial activities would represent a major revision in the City's land use policies.
2. Expanded industry and employment centers where industry has started in the San Fernando Valley, notably between Topanga Canyon and DeSoto Avenues in the vacant and agricultural areas and further north in currently vacant and agricultural land along Nordhoff Street.
3. Low density and very low density housing comparable to Figure II-100 in the Santa Monica Mountains will be developed in currently open space lands along the presently vacant northern border of the City, in the Angeles National Forest, and in the vacant areas of the Santa Monica Mountains.

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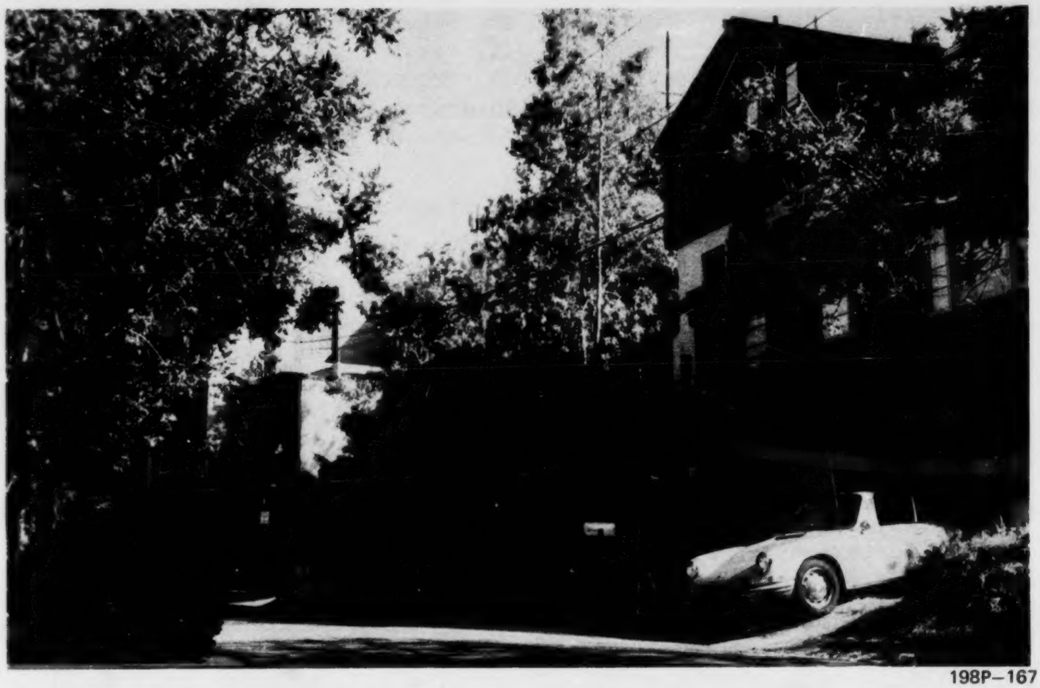

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Figure II-100. Low density and very low density residential development built into the hillsides such as these homes off Coldwater Canyon will be continued on the north and east portions of the San Fernando Valley.

4. Expansion of the western end of Griffith Park and Elysian Park at the intersection of the Gold State and Pasadena Freeways.
5. Development of the Los Angeles River and its tributaries in the San Fernando Valley and south of Griffith Park as greenbelts.
6. Promotion of high density residential around centers including the Wilshire Corridor and in the San Fernando Valley along Victory Boulevard.
7. Development of several new freeways, including:
   - Two east-west freeways in the San Fernando Valley paralleling Saticoy and Rinaldi Streets;
   - One loop freeway extending the Long Beach Freeway through South Pasadena, parallel to Foothill Boulevard ending north of San Fernando;

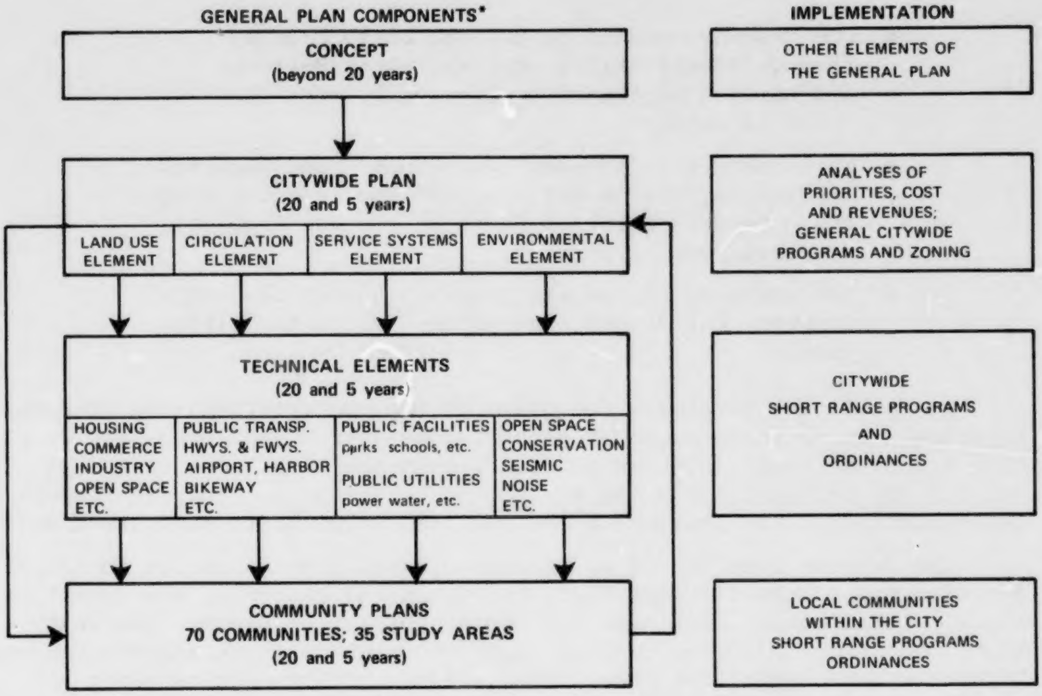
- One freeway connecting the San Diego Freeway through Beverly Hills westward along Melrose and curving northward to eventually meet the Foothill loop;
- Three east-west freeway extensions: one parallel to Slauson, one on Artesia, and one from the Long Beach Freeway south of Watts to the Los Angeles International Airport;
- One north-south freeway from the harbor through Compton, Watts, and Huntington Park to the Civic Center.

To facilitate attaining the goals of the Concept Plan, the Planning Department is in the process of preparing 20-year policy plans for 35 planning areas composed of 70 communities within the City. Figure II-101 depicts the relationship among the various plans as well as the responsible agency and the implementation policies required to meet the plan.

The Concept Plan serves as input and overall guidance for the separate elements of the Citywide Plan, the Technical Elements, and Community Plans. Local communities have the responsibility to prepare Community Plans consistent with the Concept goals and provide these adopted Community Plans for aggregation into the Citywide Plan. The Community Plans are accompanied by implementation reports which contain program priorities and recommended actions designed to carry out the plan over the next five years. Urban design and socioeconomic studies are also conducted as part of the community analysis during plan preparation. Specific technical elements prepared by the Planning Department are combined with the Community Plans, the composite Citywide Plan, and the overall Concept Plan to become the overall Los Angeles General Plan.

To encourage development of multiple-family dwelling units in the Centers consistent with the Concept Plan, the Department of City Planning has been investigating the feasibility of zone rollbacks. The Department's first major study on this issue entitled Density Adjustment Study (1972) stressed the need for zoning to more closely reflect present and projected population figures. Table II-34 presents Los Angeles population in 1974 and the SCAG-allocated projections for the years 1980 and 1990 by planning and geographical areas [Southern California Association of Governments, 1976 (SCAG-76)]. Although the City's population in 1976 is an estimated 2.8 million and is projected to reach 3 million by 1990, the zoning capacity is presently 6.1 million.

The difference between these figures could severely affect the sizing of major wastewater interceptor lines or the siting of treatment plants. Presently, there are 29,397 net acres of multiple residential zoning, over 6,000 of which are in predominately single-family use. Certain areas of single-family homes are being recycled as multiple-family units, such as in West Los Angeles. However, other areas zoned multiple-family, such as in the Western to La Brea Avenues area near Pico Boulevard, appear to be stable single-family residences.


GENERAL PLAN COMPONENTS*
CONCEPT
(beyond 20 years)
CITYWIDE PLAN
(20 and 5 years)
LAND USE ELEMENT
CIRCULATION ELEMENT
SERVICE SYSTEMS ELEMENT
ENVIRONMENTAL ELEMENT
TECHNICAL ELEMENTS
(20 and 5 years)
HOUSING
COMMERCE
INDUSTRY
OPEN SPACE
ETC.
PUBLIC TRANSP.
HWYS. & FWYS.
AIRPORT, HARBOR
BIKEWAY
ETC.
PUBLIC FACILITIES
parks schools, etc.
PUBLIC UTILITIES
power water, etc.
OPEN SPACE
CONSERVATION
SEISMIC
NOISE
ETC.
COMMUNITY PLANS
70 COMMUNITIES; 35 STUDY AREAS
(20 and 5 years)
IMPLEMENTATION
OTHER ELEMENTS OF THE GENERAL PLAN
ANALYSES OF PRIORITIES, COST AND REVENUES; GENERAL CITYWIDE PROGRAMS AND ZONING
CITYWIDE SHORT RANGE PROGRAMS AND ORDINANCES
LOCAL COMMUNITIES WITHIN THE CITY SHORT RANGE PROGRAMS ORDINANCES

*All components together constitute the GENERAL PLAN.

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Figure II-101. General Planning process in the City of Los Angeles (City of Los Angeles, June, 1974).

The Department is in the process of identifying stable single-family areas within multiple zones according to land usage, age of structure, and level of substandardness. These stable areas are being considered for rollbacks to create a zoning capacity approximately 20 percent in excess of population projections of 3.2 million for the year 2000.

Table II-35 summarizes SCAG population projections for the year 1990 and compares them with current zoning and General Plan capacities in each of the 35 planning areas. An excess between zoning thresholds and plan thresholds exists, and in all cases there is an excess between 1990 population projections and the plan/zoning capacities. Citywide, the zoning capacity is 51 percent in excess off General Plan limits, and is 105 percent in excess of 1990 population projections. The City clearly has the General Plan capacity to hold a 1990 projected population of almost 3 million while reducing the zoning capacity to more closely reflect the expected population numbers.

The City of Los Angeles, compared to other large cities, has a mobile, relatively affluent heterogeneous population employed by a balance of manufacturing and service industries that have been spread throughout the City and are becoming more decentralized, notably in

Table II-34. Los Angeles population and future projections, 1974 (source: Southern California Association of Governments, 1976).

PLANNING AREA (GEOGRAPHICAL AREA)	1974	1980	1990
(CENTRAL LOS ANGELES)	1,284,108	1,294,984	1,357,773
Wilshire	186,496	191,439	198,094
Westlake	63,086	64,064	75,324
Southeast Los Angeles	187,523	188,861	192,531
Central City	16,487	18,018	24,038
Hollywood	155,385	159,114	170,266
Northeast Los Angeles	176,793	177,980	184,180
South Central Los Angeles	210,718	209,637	215,799
Silver Lake - Echo Park	70,139	71,118	72,998
North & East Central City	5,181	5,103	5,223
Boyle Heights	72,187	69,944	72,724
West Adams-Leimert-Baldwin Hills	140,113	139,706	146,596
(WESTERN LOS ANGELES)	346,580	360,459	374,394
Palms-Mar Vista	99,452	103,719	105,869
West L.A.-Century City-Rancho Park	57,805	58,567	61,177
Brentwood-Pacfc. Palisades	61,512	67,538	73,458
Venice	34,988	37,072	37,402
Westchester	43,805	44,002	46,652
Bel Air-Beverly Crest	17,758	18,078	20,663
Westwood	31,260	31,483	32,173
(SAN FERNANDO VALLEY)	979,163	1,021,882	1,082,919
Chatsworth-Porter Ranch	45,574	51,352	73,362
Granada Hills-Knollwood	67,541	63,721	67,143
Sylmar	40,863	42,964	45,897
Pacoima	49,534	49,432	50,717
Sunland-Tujunga-Lake View-Terrace-Verdugo Mountains	44,091	42,473	43,500
Northridge	50,628	51,870	53,150
Mission Hills-Panorama City-Sepulveda	81,391	84,865	85,155
Sun Valley	61,767	64,440	68,310
Canoga Park-Winnetka-Woodland Hills	134,027	150,117	174,327
Receda-West Van Nuys	68,911	71,755	71,215
Van Nuys	98,294	102,802	100,772
North Hollywood	87,345	89,282	90,542
Encino-Tarzana	72,603	76,349	77,359
Sherman Oaks-Studio City	76,794	80,460	81,470
(HARBOR AREA)	150,368	162,781	170,331
Torrance-Gardena Strip	32,656	34,289	34,759
Wilmington-Harbor City	55,036	58,889	60,499
San Pedro	62,676	69,603	75,073
LOS ANGELES TOTAL	2,760,219	2,840,106	2,985,417

Table II-35. Population projections, zoning, and General Plan capacities by planning and geographical areas in the City of Los Angeles.

PLANNING AREA (GEOGRAPHICAL AREA)	1990 SCAG PROJECTION	EXISTING GENERAL PLAN CAPACITY	EXISTING ZONING CAPACITY	EXCESS/(DEFICIT) BETWEEN GENERAL PLAN CAPACITY AND ZONING CAPACITY
(CENTRAL LOS ANGELES)	1,357,773	1,758,200	3,218,300	1,460,100
Wilshire	198,094	236,300	415,600	179,300
Westlake	75,324	88,600	187,400	98,800
Southeast Los Angeles	192,531	212,000	378,300	166,300
Central City	24,038	41,400	14,900	(26,500)
Hollywood	170,266	250,500	628,600	378,100
Northeast Los Angeles	184,180	266,400	462,000	195,600
South Central Los Angeles	215,799	237,000	394,400	157,400
Silver Lake - Echo Park	72,998	87,000	206,000	119,000
North & East Central City	5,223	7,700	7,700	0
Baldwin Hills-West Adams-Leimert	146,596	249,300	383,400	134,100
Boyle Heights	72,724	82,000	140,000	58,000
(WESTERN LOS ANGELES)	374,394	599,500	708,600	109,100
Palms-Mar Vista	105,869	131,500	116,000	(15,500)
West Los Angeles-Century City-Rancho Park	61,177	106,600	133,000	26,400
Brentwood-Pacific Palisades	73,458	83,500	112,300	28,800
Venice	37,402	81,900	79,400	2,500
Westchester-Playa Del Ray	43,652	93,000	106,000	13,000
Bel Air-Beverly Crest	20,663	37,300	82,000	44,700
Westwood	32,173	65,700	79,900	14,200
(SAN FERNANDO VALLEY)	1,082,919	1,443,300	1,815,800	
Chatsworth-Porter Ranch	73,362	77,500	97,000	19,500
Granada Hills-Knollwood	67,143	74,000	64,000	(10,000)
Sylmar	45,897	74,400	72,300	(2,100)
Pacioma-Arleta-Lake View Terrace	50,717	91,500	80,000	(11,500)
Northridge	53,150	62,800	49,000	(13,800)
Mission Hills-Sepulveda-Panorama City	85,155	109,000	110,000	1,000
Sun Valley	68,310	78,600	89,200	10,600
Canoga Park-Winnetka-Woodland Hills	174,327	193,000	182,000	(11,000)
Receda-West Van Nuys	71,215	105,800	157,800	52,000
Van Nuys	100,772	135,300	230,000	94,700
North Hollywood	90,542	122,800	241,000	118,200
Encino-Tarzana	77,359	97,600	112,000	14,400
Sherman Oaks-Studio City	81,470	119,000	220,500	101,500
Sunland-Tujunga-Shadow Hills-Verdugo Mountains	43,500	102,000	111,000	9,000
(HARBOR AREA)	170,331	252,900	400,600	147,700
Torrance-Gardena Strip	34,759	39,300	49,300	10,000
Wilmington-Harbor City	60,499	78,600	120,800	42,200
San Pedro	75,073	135,000	230,500	95,500
LOS ANGELES TOTAL	2,985,417	4,053,900	6,143,300	2,089,400

the San Fernando Valley. The future Concept plan is oriented toward continued decentralization combined with a concentrating of development in centers that can be connected by a rapid transportation system, but that will leave the residents the choice of personal transportation on an expanded freeway system.

The extensive nature of the City promotes personal choice and the climate encourages recreational activities. The Concept plan (Figure II-99) includes greenbelts along the Santa Monica Mountains and at Griffith Park and the protection of marine waters and beaches to retain the desirability of the Los Angeles area. The existence of a large, diverse and experienced labor pool, good communications, transportation, and community services, and the new vertical nature of the downtown area could encourage major employers, such as financial institutions, to locate within the Los Angeles area. The results of these employer locational decisions could encourage nearby high-rise condominiums or extensive distant single-family tract development. City taxing and land use policies, decisions by lending institutions, and community services availability are contributing factors to the future shape of the City of Los Angeles.

Population projections of the facilities plan utilize SCAG 1990 population estimates. Since these estimates do not exceed either zoning or Plan capacities as shown in Table II-35, the population projections of the facilities plan are consistent with the expected growth, the General Plan and the existing zoning limits. Population in excess of SCAG 1990 projections would require additional facilities.

3. COMMUNITY SERVICES

Public and private agencies alone or in combination provide a community with a variety of services ranging from amenities to basic requirements. A complete list would be lengthy but examples include cultural enrichment, police and fire protection, recreation, water and power, health care, education, and communications. This section of the report provides basic information about fire protection, public safety, health care, solid waste disposal, and the provision of basic utilities of the level of service provided for residents of Los Angeles. Services are addressed on a Citywide and San Fernando Valley vs. Coastal Plain basis in this section, while the quality of community environment is addressed in a later section (II.E.9).

The relationship between the services addressed in this section and wastewater facilities is tangential. Assuming economic growth is sufficient to produce population growth, individual residential choices may be partially conditioned by available community services. This is particularly true for education services and less true for police and fire protection and health care where public information on the quality of service tends to be limited. Provision of some services, particularly health care, presents special problems for wastewater treatment because of the nature of the discharges.

a. **Educational Facilities.** The Los Angeles Unified School District (LAUSD), which has 663 elementary and secondary schools, had an enrollment of 745,000 students in 1975. The school system is decentralized into 12 administrative districts to allow for more efficient treatment of area problems and for greater community involvement. The overall budget for the LAUSD is over $1.2 billion.

In addition to regular elementary and secondary school programs, the system provides for special programs including children's day care centers, English as a second language program, bilingual/bicultural program, reading support service centers, comprehensive career education, adult education, vocational education, work experience programs, regional occupational centers/regional occupational programs, alternative schools, schools for the handicapped, schools for the gifted, and Los Angeles community colleges.

Because of a mobile population it periodically becomes necessary to build new rooms. The School District must have or obtain land for such purposes and then pay about $50,000 for each single portable classroom (by construction costs of 2/75). New school facilities generally take about 3 years from establishment of need to opening of school. Growth in enrollment, requiring the addition of new facilities, is occurring in certain areas, especially the San Fernando Valley. In other areas older facilities have excess capacity but innovative educational programs are using portions of this available space and the School Earthquake Safety Program discourages marginal building use.

Although the voters passed several bond issues from 1952-66 in the amount of $827 million, new school bond issues have not been passed since 1966 and local educators feel that state monies are not adequate to fund programs at the "desirable" level. There is a lack of funds for capital improvements and maintenance of facilities. Despite a total income of over $871 million for school year 1974-75 (income was 8 percent Federal, 35.7 percent State, and 56.3 percent Local), expenditures still outran income by about $24 million leaving a balance of about $100 million in June, 1975. Los Angeles Unified School District with an average daily attendance (ADA) for 1974-75 of 670,165 (about 432,000 for grades Kindergarten through 8 and about 238,000 for grades 9-12) had an average of 30 students per classroom. In elementary schools the range spanned from under 15 to 45 students per room.

Educational achievement in the LAUSD is often below the national average, particularly in the inner city. The mean 9th medium 6th grade reading score was only 33 (the national average is 50). The inner city represents a major portion of the priority area cluster with relatively high percentages of households with the rent/income ratio greater than 25 percent, families with female heads, high proportion of high school dropouts, families receiving welfare, renter occupied units with 1.51+ persons per room, relatively low percentages of college graduates, and 1970 median 6th grade reading scores in the range of 10 to 20, below the Los Angeles average.

The cost per ADA in the LAUSD in 1975 was $1,336, which is about average for the county. According to 1972 figures, salaries for Los Angeles County elementary school teachers was $14,149 while high school teachers received $14,911. The modified assessed valuation of the district for 1974-75 was about $10.6 billion.

One other aspect of LAUSD deserving mention is the percentage of racial and ethnic change. In the period 1966-74 the percentage of combined minorities has risen steadily from 43.9 to 58.1. In 1974 the LAUSD elementary schools included 62 percent minority enrollments including 25 percent Black, 32 percent Spanish-surnames, and 5 percent Asian-American. All minorities made up 56 percent of LAUSD junior high school students including 25 percent each for Blacks and Spanish surnames, 5 percent Asian-American, and 1 percent other minorities. High school students in the district included 24 percent Black, 22 percent Spanish-surnames, 6 percent Asian-American, and 1 percent other minorities. The total minority percent for high schools was 52 percent.

b. Fire Protection and Public Safety in Los Angeles. The Fire Department is responsible for the protection of citizens' lives and property from the inherent dangers of fire. Reducing or eliminating such hazards in accordance with this Plan directly affects the safety of both life and property. The Fire Department's activities include fire prevention, fire suppression and rescue, and emergency ambulance service.

From all traditional points of view, the Los Angeles Fire Department is one of the best in the country. It is the only major city fire department to have received the Insurance Services Office Class 1 rating, and it is continually modernizing its operations, having recently opened a centralized dispatching and control center, and it is expanding and improving its helicopter fleet.

In addition, the fire problem in Los Angeles is less severe than it is in other large U.S. cities. In 1974, the rate of structural fires per 1,000 population was 3.45, which places Los Angeles in the National Fire Protection Association's "low quartile" of building fire rates for cities over 300,000 population. The factors which influence this low rate are not precisely known, but it is likely that Los Angeles' low population - and hence building - density and its warm climate, meaning less use of potentially hazardous heating devices, are among them.

(1) DELIVERY SYSTEM ASSESSMENT. There are 102 land-based fire stations, with two other stations having only fireboats. These fire stations are grouped into 18 Battalions, and the Battalions are divided among three Divisions. These operational parts of the Department, including ambulance services, are under the Bureau of Fire Suppression and Rescue. The Bureau of Support Services handles supplies, communications, and training, while the Bureau of Administrative Services prepares the budget and handles payroll, personnel, and other auxiliary requirements. The Bureau of Fire Prevention approves plans for large buildings and conducts fire safety inspections in industrial and commercial buildings.

The Fire Department must certify that a building project complies with the Fire Code before a certificate of occupancy can be issued by the Department of Building and Safety. Since the Fire Code stipulates maximum distances (based on water pressure, construction materials, building safety features, and type of development) for the closest fire-fighting unit, development projects must be coordinated with fire-fighting services. The Fire Department generally tries to anticipate the need for new stations 5 to 7 years in advance. It is now expected that at least two additional facilities will be needed in the near future to provide for growth now occurring and projected to occur in the foothills around the San Fernando Valley over the next 7 years. One of these new stations would be in Canoga Park, the other in Northridge. In the past, Fire Department growth closely paralleled city growth with the exception of the Valley "boom" years, when fire service did not keep pace with growth. The Fire Department policy is to expand to meet new service demands as long as adequate funding is provided through the city budget.

Factors affecting fire station distribution and overall fire protection for a given area are based upon land use, required fire flow, response distances, street patterns, and traffic volume. The required fire flow is the rate of flow (gallons of water per minute) needed for fire fighting purposes to confine a major fire to the buildings within a block or other group complex. This flow is determined at appropriate locations in each fire station district of the City and depends upon the building size, type of construction, actual occupancy use, automatic sprinkler protection, and exposure to buildings within the surrounding block or group complex. Generally, the distribution of fire stations allows men and equipment to arrive at fires within three to five minutes after receipt of an alarm from the dispatcher.

By 1995, it is proposed that the number of fire stations be increased from 104 to 109. Also, because of inadequate size, locations, and maintenance costs, 45 stations are proposed to be rebuilt, relocated, consolidated, or expanded. Fewer strategically placed stations, and improved management of personnel by consolidating fire stations into task forces, has resulted in an increase of effectiveness in fire protection.

The following is a breakdown of existing and proposed fire stations:

EXISTING AND PROPOSED FIRE STATIONS	TOTALS
Existing	104
Proposed	9
Proposed Eliminations*	-4
PROJECTED TOTAL (1995)	109

ESTIMATED INADEQUATE	TOTALS
Proposed Rebuilding at Same Site or Relocating in Same General Area	16
Proposed Relocations	21

Proposed Consolidations*	7
Parking Space Expansion	1
PROJECTED TOTAL (1995)	45

*Includes the elimination of four stations by the consolidation of seven inadequate and one proposed station into four consolidated stations. Other consolidations may occur in the future to stations which are shown to be inadequate.

The goals of the Fire Department include:

- Immediate and safe access to all areas by fire fighting personnel.
- The installation of both primary and secondary water and power systems in major buildings.
- Adequate fire alarm systems.
- Installation of communications systems, automatic fire detection and extinguishing systems in high-rise or complex structures.
- Elevators and other systems to assist firemen in reaching and combating fires in large structures.

A particular problem for the Fire Department is the brush area of the City, which covers more than 133 square miles of mountain and brush land and is the only large remaining territory within the City for major development (Figure II-102). A high degree of hazard exists in these areas due to dry and windy climatic conditions as well as rugged terrain and highly flammable native vegetation. Hence, more than 175 miles of fire roads and firebreaks are maintained in the brush areas of the City. Future development of the brush areas of the City must be guided and regulated if maximum fire protection for the residents and natural resources is to be provided.

The diversity of man-made and natural features which have contributed to the City's growth also adds to the complexity of providing fire protection for inhabitants of the City, in particular, the Los Angeles Harbor and the Los Angeles International and Van Nuys Airports. Fire stations serving these facilities contain specialized fire apparatus. For example, aircraft crash apparatus is housed in fire stations on airport properties, while fire boats and scuba diver teams are housed in the Harbor area.

c. Public Safety. Crime in Los Angeles, much like every other major city, has become a focal point of citizen interest and important as a local political issue. The problem of crime and its control is especially acute in certain areas where one can expect that sooner or later he or she will become a victim. Problem areas in Los Angeles include Central and South Los Angeles, Hollywood, Pacoima, and Venice (Department of City Planning, 1974).

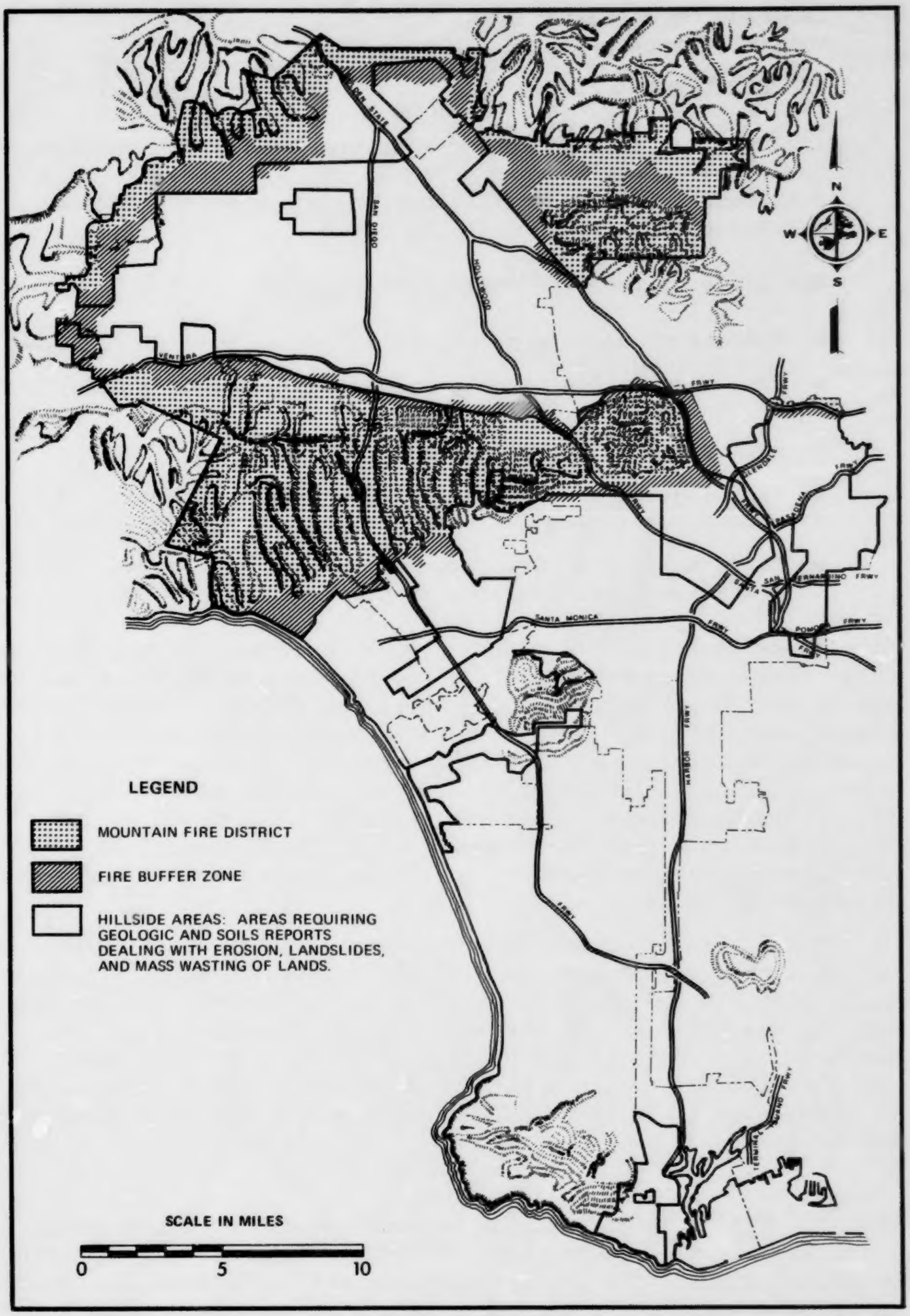
LEGEND
MOUNTAIN FIRE DISTRICT
FIRE BUFFER ZONE
HILLSIDE AREAS: AREAS REQUIRING GEOLOGIC AND SOILS REPORTS DEALING WITH EROSION, LANDSLIDES, AND MASS WASTING OF LANDS.
SCALE IN MILES
0
5
10
N
S
E
W
VENTURA
SAN DIEGO
HOLLYWOOD
SANTA MONICA
HARBOR FRWY
SAN BERNARDINO FRWY
POMONA FRWY
198P-171

Figure II-102. Mountain fire districts in Los Angeles.

The Los Angeles Police Department (LAPD) is the City agency charged with the primary responsibility for crime prevention. To the extent it fails in its preventative role, it then has the additional responsibility of law enforcement and apprehension of suspected violators. Once the alleged criminal is apprehended, the City of Los Angeles has a minimal impact on the suspect. The County, State, and Federal Governments have the major responsibility for elements in the criminal justice system that extend beyond the primary elements of crime prevention and law enforcement.

The City's view of how to operate within this framework is best summarized in the following excerpt from a Los Angeles planning document:

> Given this dichotomy of responsibility it is believed that best results can function where the impact of City control can best be felt. Therefore, the best way for the City to have an impact on the crime rate is to implement programs which improve the ability of the law enforcement agency to maintain a consistent police presence. The theory here is that an effective policy presence deters crime by the threat of apprehension and by eliciting positive citizen attitudes concerning the importance of community/police cooperation to reduce crime (Department of City Planning, 1974).

With respect to its crime prevention function, the effectiveness or output of the LAPD can be partially measured by reference to certain crime indices. Table II-36 and II-37 represent selected crime statistics for Los Angeles and the United States. Of the categories listed on both tables, and in comparison with other cities with over one million in population, Los Angeles has lower crime rates. The one exception is aggravated assault, although it is obvious from reference to Table II-36 that large cities have crime rates in all categories well above the national average (some of this disparity may be due to better reporting).

Furthermore, a study of six major police jurisdictions including the LAPD and the Los Angeles County Sheriff's Department yielded the following range of information concerning crime and law enforcement in large metropolitan areas (RAND, 1971). Part I crimes per capita (Part I crimes are considered as homocide, forcible rape, aggravated assault, robbery, burglary, ground larceny, and auto theft) varied from 0.03 to 0.14. According to Table II-38, the Los Angeles rate is 0.099 on the same scale. Police budgets ranged from $13 to $85 per capita. The figure for LAPD was $28.06 (see Table II-38). Uniform patrol strength per 1,000 residents varied between 1.0 and 2.5 (as of December 1976 the figure was 2.62 for Los Angeles); patrol cars on the street per shift per square mile varied between 0.045 and 2.7. Finally, annual Part I crimes per uniformed policeman ranged from 26 to 70. The current figure for L.A. is 29.97 (LAPD, 1977).

During the 1960s, police strength as measured by police per capita increased less rapidly than reported crime per capita, but the ratio of

Table II-36. Part I crimes, United States, 1971

POPULATION GROUP	TOTAL (1)	CRIMES OF PASSION			ECONOMICALLY MOTIVATED CRIMES			
		MURDER (2)	RAPE (3)	AGGRAVATED ASSAULT (4)	ROBBERY (5)	AUTO THEFT (6)	LARCENY (7)	BURGLARY (8)
United States	2,907	9	20	177	187	457	909	1,148
SMSA's	3,547	10	24	201	255	600	1,074	1,382
6 cities, over 1,000,000	5,779	21	42	388	862	1,177	1,199	2,089
21 cities, 500,000-999,000	5,406	20	52	357	525	1,143	1,313	1,997
30 cities, 250,000-499,999	4,759	14	35	277	359	901	1,224	1,950
98 cities, 100,000-249,999	4,383	11	27	240	266	739	1,350	1,790
200 cities, 50,000-99,999	3,223	6	17	151	126	499	1,180	1,243
509 cities, 25,000-49,999	2,798	5	12	131	95	397	1,117	1,042
1,224 cities, 10,000-24,999	2,244	4	10	123	51	251	924	880
2,810 cities, less than 10,000	1,829	4	8	128	31	173	763	722
Rural areas	1,032	7	11	101	15	70	344	485
Suburbs*	2,411	4	14	117	70	306	924	975

*Also included in above city groupings.

NOTE: The figures in this table are offenses known to police per 100,000 population. Detail may not add to total because of rounding.

SOURCE: Federal Bureau of Investigation, Uniform Crime Reports, 1971.

Table II-37. Selected crime indicators (City of Los Angeles, 1970).

Burglaries*	per 1000 housing units	39.5
Robberies	per 1000 population	4.6
Auto thefts	per 1000 population	10.9
Aggravated assaults	per 1000 population	5.3
Murders	per 1000 population	0.1
Rapes	per 1000 population	3.86

*This is equivalent to 1,395.00 burglaries per 100,000 population.

SOURCE: Department of City Planning, 1974.

Table II-38. Selected public safety indicators.

VARIABLE	CITYWIDE MEAN, 1970
FIRE	
Structural Fires/100 Improved Parcels	1.97
Fire Loss Greater $1,000/10,000 Improved Parcels	21.7
Fire Engine Company/1000 Improved Parcels	0.18
Fire Engine Company/10,000 Population	0.37
Fire Engine Company/$1,000,000 Improved Value	0.34
Malicious False Alarms/100 Population	0.43
Change Malicious False Alarms/1000 Population	2.3
Arsons & Suspected Arsons/Improved Parcels	1.1
POLICE	
Major Part I Felonies/100 Population	0.99
Total Arrests/1000 Population	8.4
Juvenile Probations/1000 Elementary Enrollment	4.90
Value of Burglary & Robbery Loss/100 Population	$16.30
Per Capita Police Costs	$28.06

SOURCE: Department of City Planning, 1974.

police per capita did increase. For example, Part I crimes per capita grew during the 1960's by 50 percent in two of the six jurisdictions studied and by 180 percent in two others, whereas uniformed patrolmen per capita grew between 12 and 43 percent. As a result workload per patrolman grew but at a slower rate than the increase in crime. Calls for service per patrolman increased by 30 to 45 percent and reported crime per patrolman increased by 35 to 160 percent (RAND, 1971). Clearly, the law and order issues faced by Los Angeles are big city problems and not unique to the area.

In recent years expenditures allocated in the City budget for police functions have increased very little. In the fiscal year 1974-75 the Police Department budget was approximately $181 million. By fiscal year 1976-77 this allocation had increased to roughly $200 million to support a department of 10,437 persons (City of Los Angeles, 1976). The 1976-77 expenditure levels represented a one percent increase over the 1975-76 fiscal year.

The same expenditure pattern characterizes the allocations for the 3,467-person Fire Department. The 1976-77 budget allocation of approximately $85 million is $34,000 less than the 1975-76 allocation. Whether the level of service for both Police and Fire Departments implied by Table II-38 can be maintained under these budget constraints is unknown at this time.

d. Health Care Resources in Los Angeles County. Health care and wastewater facilities are interrelated in a variety of ways. Hospitals represent concentrated sources of wastewater flow both in terms of quantity and constituents. Additionally, if wastewater facilities accommodate additional population growth, health care facilities will have additional demands placed on them by whatever growth occurs. Data provided by the Comprehensive Health Planning Council of Los Angeles County indicates that while surplus capacity of both hospitals and physicians exists when viewed from an overall or countywide perspective, local and specialty deficiencies exist (Comprehensive Health Planning Council, 1973; Department of Health Services, 1975 and N.D.).

Certain Hospital Service Areas, because of location, the presence of large teaching hospitals, or the supply of physicians nearby, have more hospital capacity than would be expected from the size of the population. Others have less capacity than the average.

(1) UTILIZATION OF ACUTE HOSPITALS BY HOSPITAL SERVICE AREA. The use of Hospital Service Areas for planning is mainly for convenience and does not imply that the need to coordinate the planning of health services and facilities among health providers should be confined to the boundaries of the HSA's, or even to the County boundaries. The analysis of utilization patterns by HSA is based on comparing estimated utilization of inpatient beds by the population with the actual experience in 1971 and then analyzing the implications for 1978. In general, by 1988 there will be a slight deficit of hospital beds when compared with the expected utilization of the whole County population. However, the present problems of maldistribution of resources is what will be exaggerated, unless vigorous efforts are made to disperse resources and plan and carry out solutions which meet the preferences and needs of the consumers as well as those of the providers. If the present patterns continue, only HSA's 810, 818, 820, 821, and 824 will have surpluses of beds: a situation to be alleviated not solely by building more hospitals.

The residents of Los Angeles County are in no danger of failing to receive care due to any deficiency of resources. Only a catastrophy of horrendous proportion could seriously deplete these resources. All but a few Los Angeles hospitals operate with a comfortable margin of vacancy, many with an uncomfortably large one. Changes in patterns of medical practice and a stabilizing of population size would indicate that hospitals in Los Angeles are equipped to handle the population's medical care for many years to come and there is little justification for adding more resources where those present are underutilized. One bed type, acute psychiatric beds, appears to be an exception; however, surplus medical and surgical beds can be converted to fill this need.

The cost of maintaining unused beds is staggering. In 1973 dollars, the investment for 3,000 hospital beds is $126 million, using an average cost per bed of $42,000. If the cost of maintaining one of these beds is computed at $16 per day for maintenance and overhead costs, plus seven percent of the investment (looked at either as interest on loans or lost return on idle investments) the annual cost for 5,000 beds is $26,340,000.

Some patterns in the delivery of health services which are already known to those familiar with the practice of medicine in Los Angeles County are substantiated by the results of the projection developed by COMP-LA. Many people are traveling outside their own areas for hospital service. The volume of such movement into some HSA's indicates that many people are attracted by other than superspecialty services.

Many residents of the northern Antelope Valley (in Kern County) use the hospitals in the Los Angeles County portion of the Valley. At the same time, many Antelope Valley residents seek much of their care elsewhere. There appears to be a net in-flow of people for hospital admissions to this area. The same appears to be true along the Los Angeles-Orange County border, although in recent years some movement in the other direction is reported. HSA's 818 and 824 report more hospital admissions than estimated for their populations. Part of this can undoubtedly be attributed to in-flow from Orange County, although other factors also contribute.

The San Gabriel Valley projections are well in excess of the actual experienced admissions. This holds true for the Pomona Valley, Rio Hondo, Montebello, and Whittier, indicating that residents of that entire region are receiving services elsewhere. The shortage of physicians in that area probably accounts for much of this phenomenon.

HSA's 820, 821, and 824, covering the Central Los Angeles, Santa Monica, and Long Beach areas respectively, are known to contain large hospitals offering superspecialty services which attract people from throughout the County and beyond its borders, even from out of state and the nation. These areas include the well-respected facilities at U.C.L.A. and U.S.C. Because of their reputations, some hospitals also attract patients from outside their areas for other than superspecialty services. HSA 810, covering much of the San Fernando Valley, apparently attracts fewer patients from other areas than leave the area for superspecialty services in HSA's 820 and 821.

The most recent inventory of physicians, by specialty, practicing in Los Angeles County was obtained from the "Periodic Survey of Physicians," Center for Health Services Research and Development, AMA, November 1971. Using zip codes, a total of 12,449 physicians were distributed to the nineteen Hospital Service Areas. (It should be noted, however, that there is a question regarding precision of location because the physicians were listed by mailing address which may or may not correspond with geographic location of practice.) The estimated rates of total productivity then were applied to each physician type. In other words, the last known number of practicing physicians, by specialty and by HSA, was multiplied by the latest known productivity factor.

In Los Angeles County, there is an overall surplus of physician resources when estimated physician patient load is compared with estimated patient use of ambulatory or outpatient services (office visits and home visits). Even with consideration of an unmet need factor and an estimated demand for physician services from persons residing outside of Los Angeles County, there is a 10 percent current surplus of physicians. Obviously, this excess is neither distributed equally throughout the County nor among HSA's. In 1971, there were seven HSA's (810, 812, 813, 820, 821, 823, and 824) with an overall surplus, ranging from a low of 63 physicians (HSA 812) to a high of 2,317 physicians (HSA 820). As anticipated, the greatest excesses occur in the HSA's with the greatest concentration of physicians as well as other health care resources. The 12 remaining HSA's have an overall deficit, ranging from a high of 222 physicians (HSA 825) to a low of nine physicians (HSA 808).

When the allotment of physicians is examined by specialty, there is a countywide deficit of general practitioners; not one HSA has an adequate supply. Eleven HSA's have a shortage of internists and 12 have a shortage of pediatricians. Yet, there is an overall surplus of 761 internists and 222 pediatricians. Concurrently, 15 HSA's have an excess of surgeons and 13 have an excess of obstetricians-gynecologists, again occurring in the areas with greatest concentration of health care resources and services. Although it would be obvious to conclude that physicians are severly maldistributed in Los Angeles County, it would be judicious to recall that people will continue to purchase health care services, particularly secondary and tertiary, not located in the immediate vicinity of their home.

In Los Angeles County, there is an overall surplus of physician resources when estimated physician patient load is compared with estimated patient use of ambulatory or outpatient services (office visits and home visits). Since physicians tend to aggregate where health care resources are located, this excess is neither distributed equally throughout the County nor among HSA's. When physicians are examined by specialty, however, there is a countywide deficit of general practitioners, not one HSA has an adequate supply, which is somewhat counterbalanced by the overall surplus of internists.

e. Solid Waste Facilities in Los Angeles. Solid waste is directly related to wastewater facilities, for solids removed from treated wastewater could constitute significant solid waste load in the future. However, at the present time, only the Terminal Island Treatment Plant is hauling sludge to a landfill (Palos Verdes). In the future most, if not all, sludge will be used in landfills because of the requirements to cease ocean disposal of sludge by 1977. It is estimated that by the year 2000 approximately 1.4 million tons of sludge at a 75 percent equivalent moisture content will be generated annually. A study is under way to examine sludge disposal methods suitable for major metropolitan areas and to develop a Basinwide Wastewater Solids Management Program. The participants in the study are the Los Angeles County Sanitation Districts, City of Los Angeles, Orange County Sanitation Districts, U.S. Environmental Protection Agency, and the State of California. The results of this study could have a decided impact on the County's Solid Waste Plan. The study is tentatively expected to be completed by December 1978.

Residential waste is generated from households and generally consists of food wastes, newspapers, clothing, garden wastes, domestic animal wastes, bulky items such as large appliances and furniture, and packaging materials including tin cans, bottles, paperboard, and plastic items (see Figure II-103). Approximately 4,000,000 tons, or 30 percent of the total waste produced in

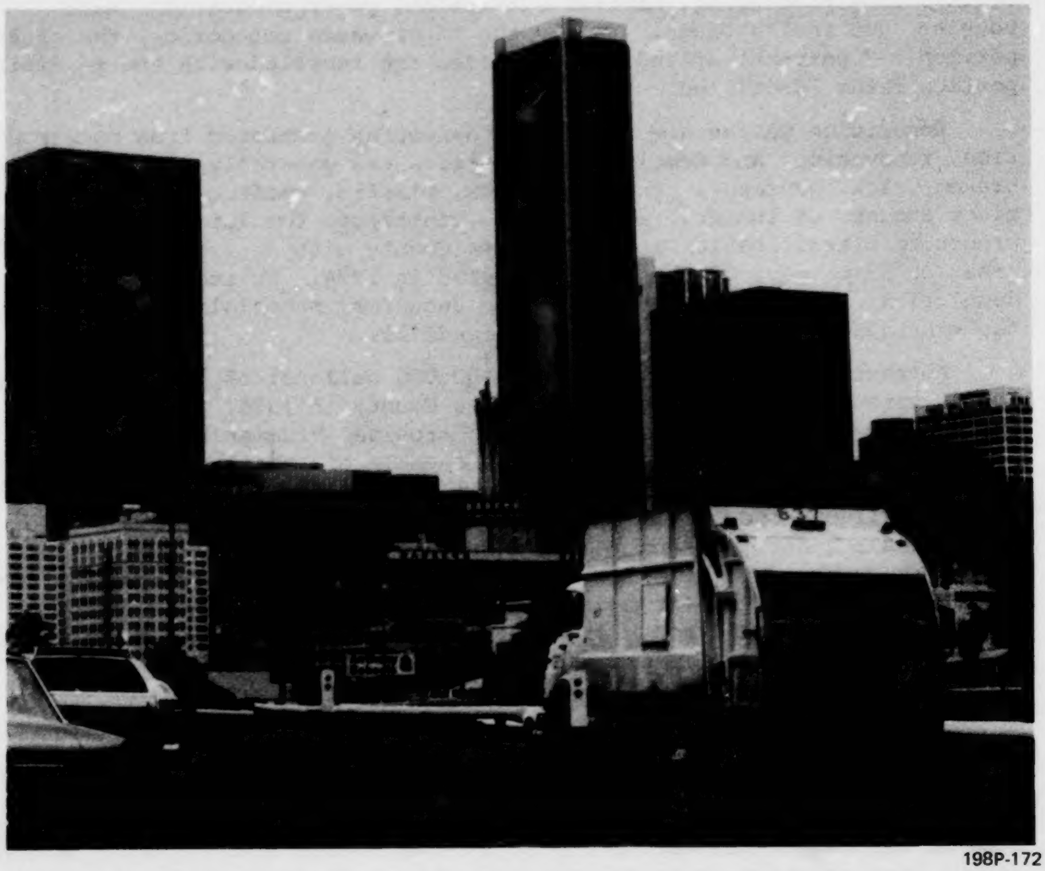
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Figure II-103. An estimated 15,000,000 tons of solid waste were produced in Los Angeles County in 1974. Twenty-one percent was recycled, 3 percent discharged in the ocean, and the remainder was sent to landfills.

the County, is classified as residential wastes. Estimates of daily per capita figures for these wastes vary from 2.04 pounds to 3.13 pounds with the higher figure possibly attributed to the miscalssification of wastes in the inventory classification at landfill sites. Of the total residential waste production, approximately 92 percent reaches landfills with the remaining eight percent recovered by the secondary materials industry.

Waste produced from financial establishments, retail stores, civic centers, service oriented firms, fire and police stations, schools, churches, hospitals, libraries, and military reservations and bases are considered commercial wastes. The total amount of commercial solid wastes produced in the County during 1974 is estimated to have been 2,502,200 or 17 percent of the total waste production. Of this amount, approximately 86 percent was landfilled with the remainder recovered by the secondary materials industry.

Fifteen percent of the total solid waste production in the County is attributable to industrial solid wastes from such activities as manufacturing, food processing, mineral extraction, power generation, warehousing, and fuel storage. Unlike the other waste categories, the greater portion (77 percent) of industrial wastes are recycled with the remaining portion being landfilled.

Demolition wastes are classified as wastes generated from construction, renovation, and demolition activities and generally consist of dirt, broken brick, pavement, concrete, glass, plastic, roofing materials, and minor amounts of lumber. These wastes constitute the largest solid waste producing classification in Los Angeles County with an estimated 5,270,000 tons, or 35 percent of the total produced in 1974. Thirteen percent of demolition wastes are recovered by the secondary materials industry with the remaining 87 percent disposed in landfills.

Approximately 862,000 tons (210,000,000 gallons) of hazardous liquid wastes were disposed in landfills in the County in 1974. These wastes are defined as those which are toxic, corrosive, flammable, explosive, irritating or strongly sensitizing and capable of causing substantial personal injury, serious illness or harm to wildlife. Over 3,000 producers of liquid industrial waste use landfills for disposal, most producing small quantities and making infrequent visits to the landfill during the year. The major portions of the liquid industrial wastes received at landfills are from the oil and chemical industries. With increasingly stringent restrictions placed on industrial waste discharges, it is anticipated that more and more hazardous liquid wastes will be diverted from the sewer system and ocean to landfill sites.

Approximately 400,000 tons of sewage sludge at 75 percent equivalent moisture content were generated in 1974 by six treatment facilities in Los Angeles County and by the adjoining facility of the Las Virgenes Municipal Water District. Ninety-seven percent of this sludge was generated by the County Sanitation District's Joint Treatment Plant in Carson and by the City's Hyperion and Terminal Island Plants. The Sanitation District's plants in Saugus, Valencia, Lancaster, and Palmdale and the

Los Virgenes plant dispose of their sludge on land as soil conditioners. All but small portions of the 178,860 tons of sludge from the County Sanitation District's joint facility and the 211,680 tons from the City's facilities are discharged into the ocean.

Because of the irregular geographical shape of the City of Los Angeles, solid waste disposal sites serving the service area are interspersed throughout Los Angeles County. The 54 significant landfill sites in the County are operated independently by the Los Angeles County Sanitation Districts, various municipalities including the City of Los Angeles, and private enterprises. The service areas of most disposal sites overlap political boundaries within the Los Angeles River Basin.

The 54 significant landfill sites in the County are divided into three classes generally defined as to varying degrees of protection offered to ground and surface waters. Class I sites provide complete protection of water quality and will generally accept any type of solid or liquid wastes. Class II sites also provide reasonable protection of water quality but generally only accept nontoxic wastes or those incapable of significantly impairing the quality of usable wastes. Finally, Class III disposal sites only accept nonwater soluble, nondecomposable inert solids (Group 3 materials).

Table II-39, an activity summary for the 21 major Class I and II landfills in the County, indicates detailed data for the landfills including the opening dates, total acreage of each site and classification of the site. The remaining capacity of each landfill as of 1974 and the estimated year of completion are also indicated. Where known, the planned ultimate use for the completed site is indicated. Location and approximate service areas are shown in Figure II-104. The majority of the 11 minor Class II landfill sites receiving less than 20,000 tons of refuse annually are special use fills. Only three, Pebble Beach Landfill on Catalina Island, Owl Park, and Norwalk Dump, are open to the public. The 22 Class III landfills make up a third grouping of disposal facilities and locations of the most important of these are shown on Figure II-105. Only five of the Class III sites are open to the general public. However, one of these (Nu-Way) receives over one million tons of Group 3 materials annually. Several sites located in portions of active gravel pits are utilized exclusively by sand and gravel companies and/or their gravel customers.

Existing water pollution abatement programs are forcing an increasing volume of hazardous wastes to be diverted to the land instead of to the sewage system for ultimate disposal. The County Sanitation Districts of Los Angeles County and the City of Los Angeles, Bureau of Sanitation, confronted with the problem of improving treatment plant effluent quality to conform with the high standards of government regulatory agencies, have placed more stringent quality requirements on industrial wastewater discharges. Many industries utilizing the sewerage system have been faced with the options of installing an industrial wastewater treatment plant or finding another means of disposing of their waste. The sludges

Table II-39. Activity summary for Los Angeles County major landfills.

NO.	LANDFILL	DATE OPENED	TOTAL AREA (ACRES)	CLASS	REMAINING CAPACITY (TONS × 10^6)	ESTIMATED[1] YEAR OF COMPLETION	ULTIMATE USE
1	Palos Verdes Landfill	1957	296	I,II	0.2	1979	Golf Course & Park
2	Spadra Landfill	1957	199	II	6.0	2000 1990[2]	Recreational Greenbelt
3	Mission Canyon Landfill	1960	1,491	II	43.0	1996 1976[2]	Regional Park
4	Scholl Canyon Landfill	1961	484	II	18.3	1997 1978[2]	Golf Course & Other Recreational Facilities
5	Calabasas Landfill	1961	416	I,II	30.0	2030	Recreational Greenbelt
6	Puente Hills Landfill	1958	1,214	II	150.0	2010 1977[2]	Recreational Greenbelt
7	Toyon Canyon Park Reclamation Project	1957	110	II	0.8	1979	Park
8	Burbank Reclamation Project	1949	133	II	1.2	1990	Park
9	City of Whittier Landfill	1952	117	II	1.7	1990	Park
10	North Valley Refuse Center	1958	230	II	39.4	2000 1982[2]	Open Space Golf Courses
11	Hewitt Pit	1962	117	II	0.44	1975	Unknown
12	Bradley Avenue Dump	1961	63	II	15.0	1989 1975[2]	Unknown
13	Penrose Pit	1957	73	II	2.0	1977	Unknown
14	Azusa Western	1960	307	II	5.4	1992	Industrial Site
15	B.K.K. Landfill	1968	583	I,II	68.0	2165 1976[2]	Unknown
16	Operating Industries, Inc.	1948	190	II	3.3	1980	Unknown
17	Ascon	1965	65	II	1.16	1977	Unknown
18	Harbor Dump	1955	25	II	0.24	1976	Industrial Site
19	Chiquita Canyon Landfill	1968	40	II	1.1	1995 1976[2]	Golf Course
20	Antelope Valley Public Dump	1953	74	II	0.70	1994	Unknown
21	Lancaster Dump	1958	60	II	0.46	1988 1981[2]	Unknown

[1] The estimated year of completion is based upon the following factors: (a) the total quantities of solid waste in the County requiring landfilling will remain constant at the 1974 rate throughout all planning periods, (b) anticipated landfill closures will result in a redistribution of refuse to sites remaining in operation, hence accelerating the rate of filling of those sites.

[2] Lower figure indicates year of completion based upon the capacity remaining under existing Conditional Use Permit for the landfill. Upper figure indicates year of completion based upon the capacity remaining if Conditional Use Permit is extended.

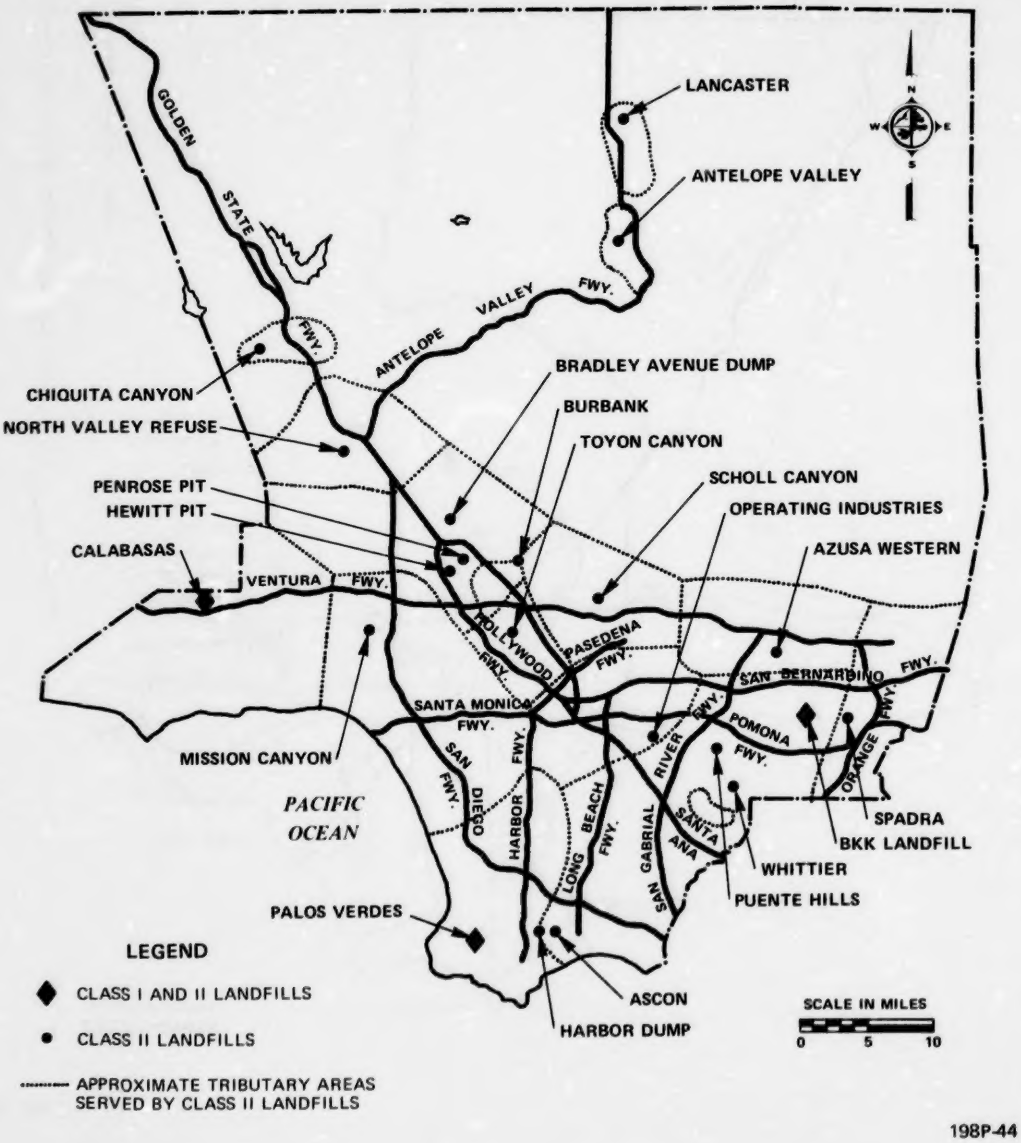
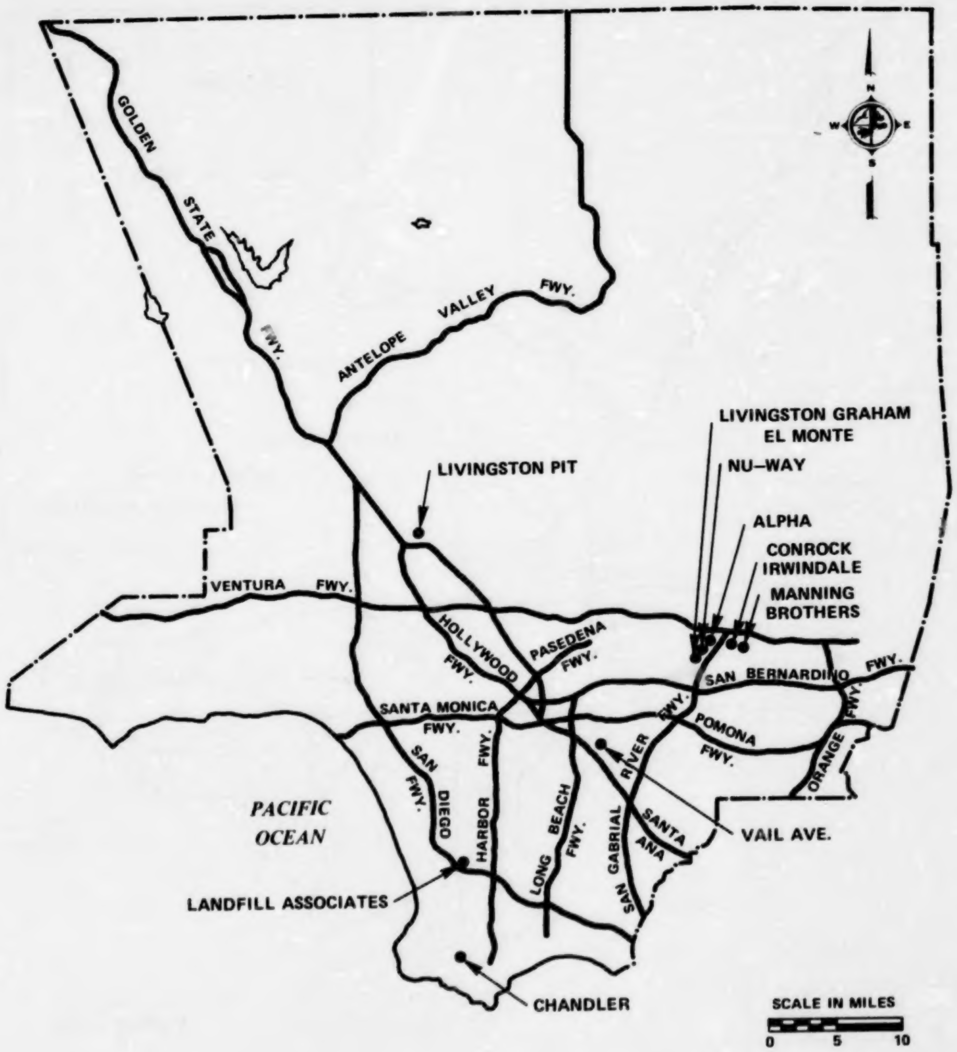

GOLDEN STATE FWY.
ANTELOPE VALLEY FWY.
LANCASTER
ANTELOPE VALLEY
N
W
E
S
CHIQUITA CANYON
NORTH VALLEY REFUSE
BRADLEY AVENUE DUMP
BURBANK
TOYON CANYON
SCHOLL CANYON
OPERATING INDUSTRIES
AZUSA WESTERN
PENROSE PIT
HEWITT PIT
CALABASAS
VENTURA FWY.
HOLLYWOOD FWY.
PASEDENA FWY.
SAN BERNARDINO FWY.
SANTA MONICA FWY.
POMONA FWY.
ORANGE FWY.
RIVER FWY.
SAN DIEGO FWY.
HARBOR FWY.
LONG BEACH FWY.
SAN GABRIAL RIVER
SANTA ANA
MISSION CANYON
PACIFIC OCEAN
SPADRA
BKK LANDFILL
WHITTIER
PUENTE HILLS
PALOS VERDES
ASCON
HARBOR DUMP
LEGEND
CLASS I AND II LANDFILLS
CLASS II LANDFILLS
APPROXIMATE TRIBUTARY AREAS SERVED BY CLASS II LANDFILLS
SCALE IN MILES
0
5
10
198P-44

Figure II-104. Major landfills in Los Angeles City.


N
W
E
S
GOLDEN STATE FWY.
ANTELOPE VALLEY FWY.
LIVINGSTON GRAHAM
EL MONTE
NU–WAY
LIVINGSTON PIT
ALPHA
CONROCK
IRWINDALE
MANNING
BROTHERS
VENTURA FWY.
HOLLYWOOD FWY.
PASEDENA FWY.
SAN BERNARDINO FWY.
SANTA MONICA FWY.
POMONA FWY.
RIVER FWY.
ORANGE FWY.
SAN DIEGO FWY.
HARBOR FWY.
LONG BEACH FWY.
SAN GABRIAL
SANTA ANA
VAIL AVE.
PACIFIC
OCEAN
LANDFILL ASSOCIATES
CHANDLER
SCALE IN MILES
0
5
10

198P-173

Figure II-105. Major Class III landfills in Los Angeles County.

and residues produced by treatment processes are generally quite concentrated and may be hazardous in nature. Liquid and semi-liquid wastes generated in treatment processes are commonly deposited in sanitary landfills.

Ocean dumping regulations adopted by the EPA to control the discharges of many hazardous wastes to the ocean, have also contributed to the increase of wastes received at Class I sanitary landfills. Wastes dumped into the ocean included outdated chemicals from laboratory and similar nonproduction facilities, pesticides, highly toxic chemicals, explosives, and other substances of a highly hazardous nature. Industries which formerly used the ocean as a disposal site have now found the sanitary landfill to be the most practical and economically feasible means of disposing of hazardous wastes.

Most hazardous wastes may only be legally disposed in Class I sanitary landfills. Presently, there are three Class I sanitary landfills in the County. The tonnages of hazardous wastes received at these landfills have increased in recent years to the extent that very little reserve capacity exists. While four Class II sanitary landfills in the County are permitted by the Regional Water Quality Control Board to handle limited types and quantities of waste liquids, hazardous materials are generally unacceptable.

The State Water Resources Control Board classification system of waste is also based on surface and groundwater quality considerations. Under this scheme liquid industrial wastes are placed in either the Group 1 or Group 2 categories. Group 1 materials contain toxic substances or materials which could significantly impair the quality of usable waters. Materials considered Group 1 wastes include acids, alkalines, pesticides, brines, oil wastes, solvents, and other materials of a toxic nature. Nontoxic liquids containing substances which are chemically or biologically decomposable and not capable of significantly impairing the quality of usable waters are considered Group 2 wastes. These include nontoxic rotary drilling muds, mud and water solutions, latex wastes, tile glaze wastes, etc. Both Group 1 and Group 2 wastes are acceptable at a Class I site while only Group 2 materials can be handled at Class II landfills.

The State Department of Health classifies industrial wastes based on public health considerations. Materials which can cause substantial personal injury or serious illness or harm to wildlife as a result of disposal are considered hazardous wastes. Hazardous wastes which can cause death, or disabling personal injury or illness as a result of disposal are placed in the Group 1 category and, therefore, can be disposed of only in a Class I landfill. However, some hazardous materials can also be considered Group 2 wastes; that is, they are potentially harmful to the public health but not harmful to the quality of usable waters. Radioactive wastes are not permitted to be disposed of in any landfill in Los Angeles County. Information regarding the disposal of these materials is contained in the *California Radiation Control Regulations* of the *California Administrative Code.*

A map showing the location of the seven Class I and II landfills receiving liquid industrial wastes in Los Angeles County and the quantities received annually is presented in Figure II-104. An estimate of the types and quantities of liquid industrial wastes currently received at these landfills in presented in Table II-40. Since the table was made by reviewing *California Liquid Waste Hauler Records* submitted during 1974 prior to the revisions in the manifest of the record, the accuracy and specifics of the data are somewhat questionable. The inordinately large quantities of Group 2 material received at some Class II sites, specifically nontoxic mud and water, appear to be the most glaring inconsistency. A more realistic estimate of the Group 1 waste disposed of in Los Angeles County is probably in the range of 400,000 to 500,000 tons per year, rather than the 298,200 tons indicated in the table.

The increasingly stringent controls on industrial wastewater discharges will result in an increased load of toxic wastes to landfills. The exact means by which industry will remove these materials from the waste stream is unknown; however, based on currently available technology, the most likely approach would be to precipitate and filter out the heavy metals. The chemical composition of the precipitate will vary depending upon the composition of the waste and the treatment process applied. In order to project the tonnages of sludge which will be produced by industrial pretreatment, a prediction must be made of the properties of the precipitates. The City of Los Angeles Bureau of Sanitation estimate of the amount of sludge which will be generated as a result of industrial pretreatment in the City of Los Angeles is shown on Table II-41. Calculations are based on the formation of one particular precipitate for each heavy metal. Although many precipitates are possible, the ones shown are the types most likely to occur. The amount of sludge produced is based on a solids concentration of 10 percent. The total quantity of sludge which will be generated by industries in the City of Los Angeles is estimated to be approximately 10,000 tons per year. Similar calculations for the County Sanitation District's sewerage system yield an additional 30,000 tons per year. This material is generally of a toxic nature and would most likely have to be disposed of at a Class I sanitary landfill. Compared to the present amount of Group 1 waste received at Class I sites, this represents approximately a 10 percent increase.

In addition to the wastes reaching sanitary landfills discussed above, the Los Angeles County Flood Control District maintains disposal sites for debris from storm runoff. A significant amount of waste material consisting mostly of sand, gravel, and rock fragments is generated as a result of erosion of mountain surfaces by streams during peak rainfall periods. This debris is collected in 108 debris basins and 14 reservoirs operated by the District and located mostly along the southerly slopes of the central mountains separating the Basin from the North County area. The District operates approximately 30 disposal sites which in a year of average rainfall receive approximately 4 million tons of debris. During periods of unusually severe rainfall, the amount of debris collected annually could amount to three times the average amount.

Table II-40. Annual tonnages and types of liquid industrial wastes received at Los Angeles County landfills—September, 1974.*

	PALOS VERDES LANDFILL	CALABASAS LANDFILL	B.K.K. CO.	PUENTE HILLS LANDFILL	SPADRA LANDFILL	ASCON LANDFILL	OPERATING INDUSTRIES LANDFILL	TOTAL
GROUP 1								
Acid Solution	363	5,281	23,762	--	--	--	--	29,406
Alkaline Solution	840	3,810	48,303	--	--	--	--	52,953
Pesticides	1	134	--	--	--	--	--	135
Etching Solution	40	38	779	--	--	--	--	857
Spent Plating Solutions	49	168	--	--	--	--	--	217
Catalyst	794	--	--	--	--	--	--	794
Brine	5,228	--	5,064	--	--	--	--	10,292
Emulsion	2,870	13	--	--	--	--	--	2,883
Tetra Ethyl Lead Sludge	312	42	--	--	--	--	--	354
Toxic Tank Bottom Sediment	31,149	629	21,034	--	--	--	--	52,812
Chemical Fertilizer	--	--	--	--	--	--	--	--
Chemical Toilet Wastes	--	--	--	--	--	--	--	--
Oil	54,306	2,803	35,284	--	--	--	--	--
Grease	510	621	--	--	--	--	--	--
Asphalt Sludge	573	4	--	--	--	--	--	92,393
Solvent	467	194	2,078	--	--	--	--	1,131
Other Toxic Solutions	19,598	2,363	28,696	--	--	--	--	50,657
SUBTOTAL	117,100	16,100	165,000	0	0	0	0	298,200
GROUP 2								
Cannery Wastes	364	5,336	13,738	--	140	--	--	19,578
Non-Toxic Rotary Drilling Mud	16,275	290	28,783	132	19	2,721	3,424	51,644
Acetylene Sludge	164	--	392	304	252	--	527	1,639
Latex Waste	687	60	--	3,802	1,073	--	24,097	29,719
Paint Sludge	2,528	1,188	3,925	5,880	956	--	2,699	17,176
Tile Glaze Waste	277	438	--	145	819	--	1,382	3,061
Lime Soda Water	385	305	1,570	23	71	5,985	2,634	10,973
Non-Toxic Mud and Water	73,042	4,861	12,298	3,756	6,105	45,980	132,335	278,377
Other Non-Toxic Solutions	69,178	7,922	28,294	2,458	3,565	29,814	10,402	151,633
SUBTOTAL	162,900	20,400	89,000	16,500	13,000	84,500	177,500	563,800
TOTAL (GROUPS 1 & 2)	280,000	36,500	254,000	16,500	13,000	84,500	177,500	862,000

*Information obtained from "California Liquid Waste Haulers Records" in use prior to December, 1974.

Table II-41. Source control of industrial heavy metals in City of Los Angeles.

METALS	PRESENT INDUSTRIAL DISCHARGE TO SEWER (TONS/YEAR)	POTENTIAL REMOVAL FROM SEWER BY INDUSTRIAL PRETREATMENT WITH DISPOSAL TO SANITARY LANDFILL (CLASS ONE)		
		AS METAL (TONS/YEAR)	AS PRECIPITATE (TONS/YEAR)	AS 10% SOLID SLUDGE (TONS/YEAR)
Arsenic	1.08			
Cadmium	0.72	0.585	0.897 as $CdCO_3$	8.97
Chromium	191.50	172	340 as $Cr(OH)_3$	3,400
Copper	125.30	110.5	325.5 as Cu_2CO_3	3,255
Lead	2.16	1.75	257 as $PbSO_4$	25.7
Mercury	0.89	0.13	0.28 as Hg_2S	2.80
Nickel	88.50	75.5	119.4 as $Ni(OH)_2$	1,194
Silver	3.75	2.25	2.99 as AgCl	29.9
Zinc	121.50	143	217 as $Zn(OH)_2$	2,170
Cyanide	Complete Destruction			
TOTALS	535.40	505.72	1,008.64	10,086.47

The Los Angeles County Flood Control District is currently in the process of obtaining Class III disposal site status for all its debris disposal sites. Although the majority of sites have adequate capacity for many years into the future, some will be filled to capacity within 10 years. In the future, abandoned gravel pits may be used for the disposal of debris or suitable debris may be utilized to repair beach front property eroded by tidal action.

f. Public Utilities.

(1) WATER SUPPLY. The development of the City of Los Angeles has been dependent, to a great extent, on its ability to acquire and maintain sufficient water supplies to support its large concentration of people. Early importation of water in the Los Angeles area was made necessary by the inadequacy of local water resources to respond to a rapidly increasing population. During this early growth period, the absence of adequate surface water supplies prompted the investigation and development of groundwater sources. Subsequently, reliable and efficient water supplies attracted industrial and agricultural interests which resulted in the overdraft of subsurface supplies and, in some locations, created seawater intrusion problems. Presently, some areas of the City are dependent on local groundwater sources; however, most of the water supply is from great distances with the main sources being the Owens Valley area, the Colorado River, and to an increasing extent, the State Water Project (Feather River).

In 1974-75, the Los Angeles Aqueducts supplied the city with 80 percent or 410.4 million gallons per day of water. An additional 14.3 percent or 73.5 million gallons per day was withdrawn from San Fernando area wells and other groundwater basins for city use. Metropolitan Water District (MWD) water from the Colorado River and California Aqueduct made up the remaining 2.5 percent and 3.2 percent of the City's water needs respectively. Future water requirements will continue to grow because of industrial requirements and increasing City population. These expanding needs will be even more acute because of the possible curtailment of water from the Colorado River. Additional water sources that will be utilized by the Department of Water and Power include the purchase of water from the State Water Project and the development of water reclamation programs to reclaim wastewater for industrial use or for the recharge of groundwater basins.

(2) ELECTRICAL POWER. Electrical power consumed in the City of Los Angeles is provided by the City of Los Angeles Department of Water and Power (DWP) . Power is supplied to the seven cities from two sources: Southern California Edison (SCE) and City-owned utilities. SCE supplies power to El Segundo, Beverly Hills, Culver City, the City of San Fernando, and Santa Monica. Both Burbank and Glendale have their own utilities which supply their power needs.

The existing sources of electrical power for the City of Los Angeles are primarily thermal generating plants and hydroelectric facilities. Figure II-106 indicates the proportions of this power contributed by each type of source for the DWP service area. In 1974-75 eleven percent of the power consumed by DWP customers was hydroelectric power generated from the Owens River Aqueduct, the California border, and the Colorado River (Hoover Dam). Most of the rest of the power was generated by the DWP's four Los Angeles Basin thermal generating plants. These plants, the Haynes Steam Plant near Seal Beach, the Valley Steam Plant at Los Angeles Harbor, and the Scattergood Steam Plant near El Segundo, provided approximately 55 percent of the City's energy requirements in 1974-75 and have the capacity to generate approximately 56 percent of the entire systems 5.9 million kilowatts net capacity (City of Los Angeles Department of Water and Power, 1976). Nuclear power plants in the San Joaquin Valley may also be a source of up to 5.2 million kilowatts by the end of the century (City of Los Angeles Department of Water and Power, 1976). The net capacity of existing generating stations is shown in Figure II-107.

In 1970, the DWP estimated that annual per capita consumption of electricity in the City was about 5,400 kilowatt hours (City of Los Angeles, 1974). During 1974-75 conservation and reduced general business activity resulted in a 0.83 percent customer load decline and a 1.71 percent peak demand decline (Board of Water and Power Commissioners, 1975).

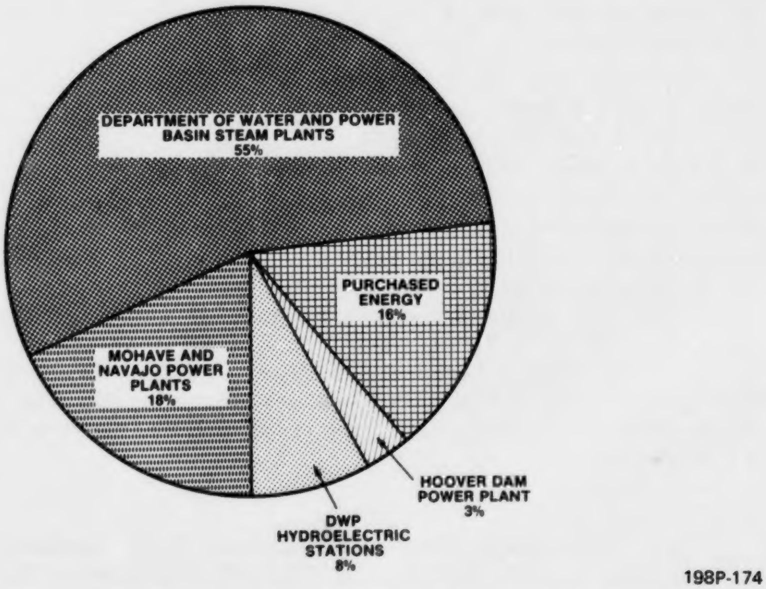


Figure II-106. Sources of net energy consumed by Los Angeles Department of Water and Power customers (City of Los Angeles Department of Water and Power, 1975a).

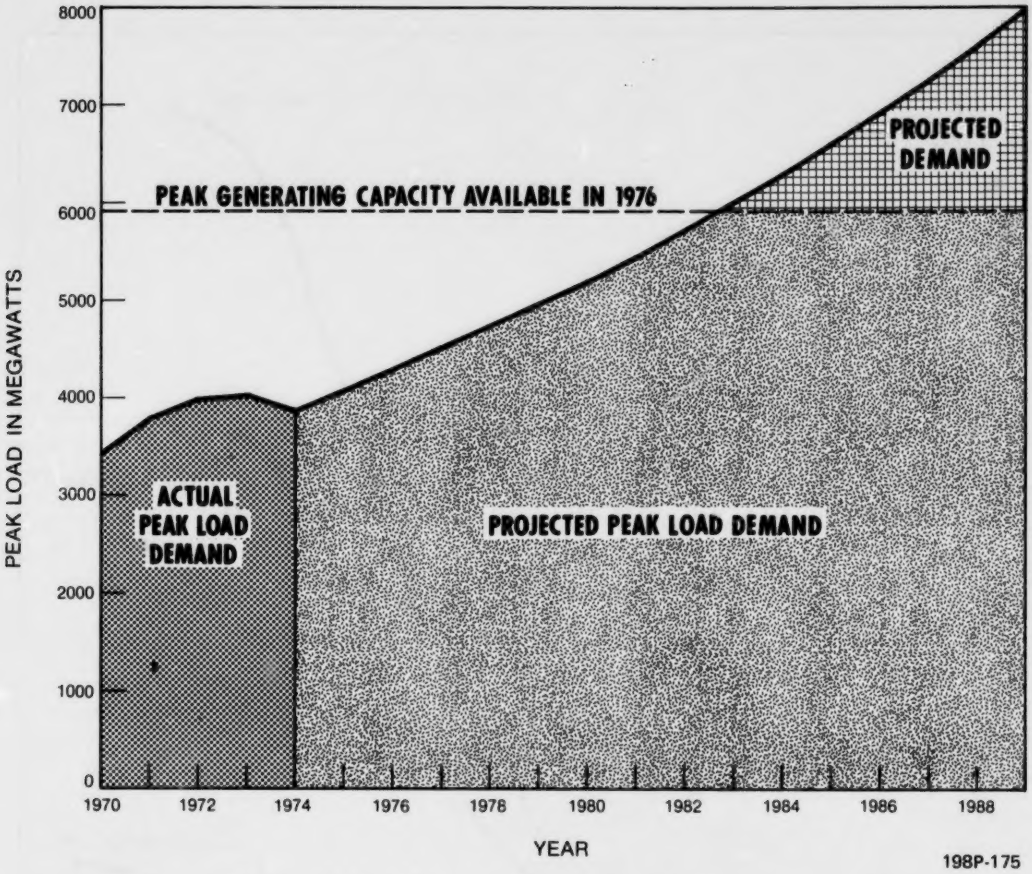


Figure II-107. Existing Department of Water and Power generating stations and net capacity (City of Los Angeles, Department of Water and Power, 1976).

The Department of Water and Power expects reductions in electrical consumption due to conservation efforts to taper off, and per capita consumption to start climbing again as electricity replaces other energy sources in the home and industry. The Department has recently projected a per capita consumption of 9,500 kwh for 1990, a 65 percent increase over current consumption (Department of Water and Power, 1976). Electrical generating capacity is being planned accordingly. Actual and projected annual energy demand and peak load growth are shown in Figures II-108 and II-109. Future plans include joint projects with other utilities. A jointly financed feasibility study for the proposed 5,200 MW San Joaquin Nuclear Project to be located in the Southwestern San Joaquin Valley is currently being reviewed. Feasibility and environmental impact studies for three proposed jointly developed coal-fueled power plants are in

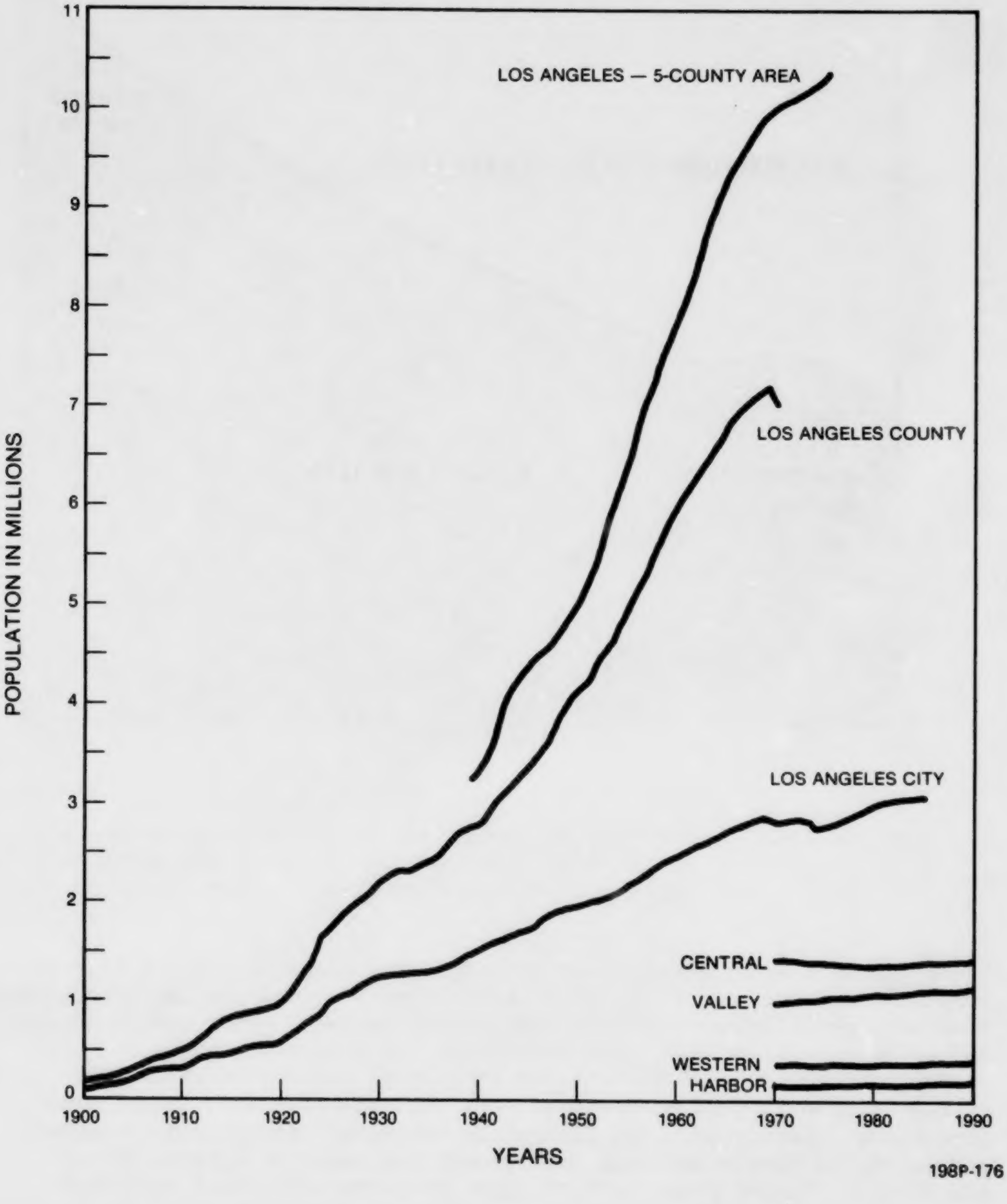


Figure II-108. Historic annual energy demand and project future demand (City of Los Angeles Department of Water and Power, 1975b).

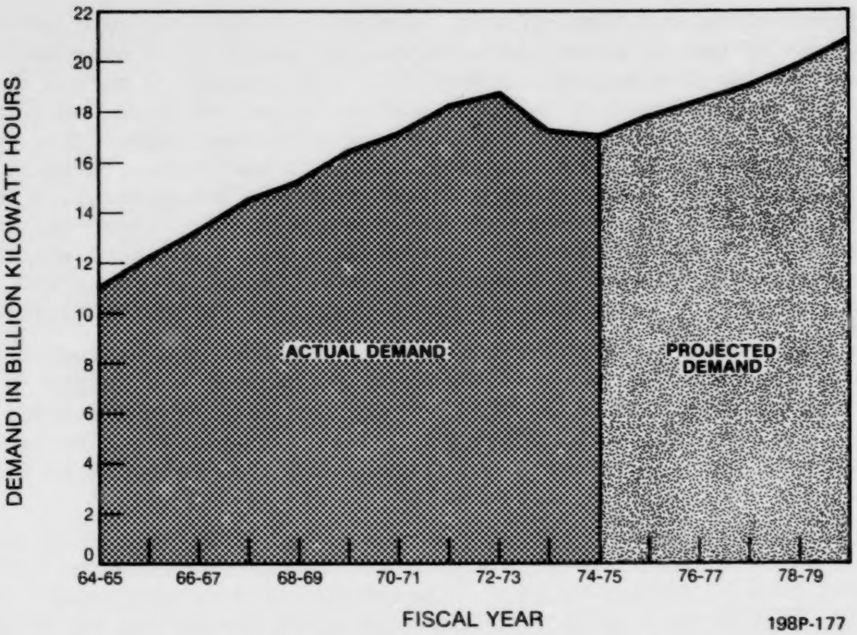


Figure II-109. Actual and projected total peak load growth for the City of Los Angeles, City of Glendale, and City of Pasadena (City of Los Angeles, Department of Water and Power, 1976).

progress. These are: South Central Utah; the Allen Power Project at approximately 2,000 MW, to be located in Clark County, Nevada; and the Warner Valley Power Project at 500 MW, to be located in Washington County, Utah. The Department also monitors and supports research in less conventional energy sources including geothermal reservoirs, wind power, processed municipal waste, gasified coal, solar collectors, and methane gas collected from sanitary landfills (Board of Water and Power Commissioners, 1975).

It is the policy of the Department of Water and Power to provide service to any customer or development requesting such service within the City limits. Every attempt is made to provide such service in a reliable and orderly manner as it is needed. Electrical capacity must of necessity have a reserve margin to prevent outages, hence Department capacity generally exceeds the everyday needs of the City (Department of Water and Power, 1976).

(3) NATURAL GAS. Economical natural gas played an important role in the growth of Southern California. Major pipelines serving California were built specifically for that purpose and only secondarily to serve

other states along the right-of-way. Electric utilities would purchase large blocks of gas as a new pipeline was installed or an existing one expanded. As the residential, commercial, and industrial market grew, natural gas was gradually withdrawn from the power stations, which substituted fuel oil, until the next pipeline expansion was made. Thus, as a result of historical factors somewhat unique to the State, there was a built-in natural gas buffer that allowed growth in residential, commercial, and industrial uses of natural gas during a period when total natural gas supplies have not increased. Ironically, this situation, which previously provided a desirable cushion, may now result in widespread shortages among the large, over-extended market of Southern California.

The major wholesaler of natural gas in the Los Angeles region is the Southern California Gas Company. About 90 percent of the supply is from the San Juan Basin, located in the Four Corners area of New Mexico, and from the Permian Basin in the West Texas area. Supplies are contracted for through the El Paso Natural Gas Company and the Transwestern Pipeline Company.

These traditional supplies are in a rapid and steady decline as shown in Figure II-110. Supplies to Southern California companies fell from 247 bcf in 1969 to 92 bcf in 1973. Future supplies to supplement dwindling, old sources are currently being contracted for by the two pipeline companies and by Southern California Gas Company, but available supplies

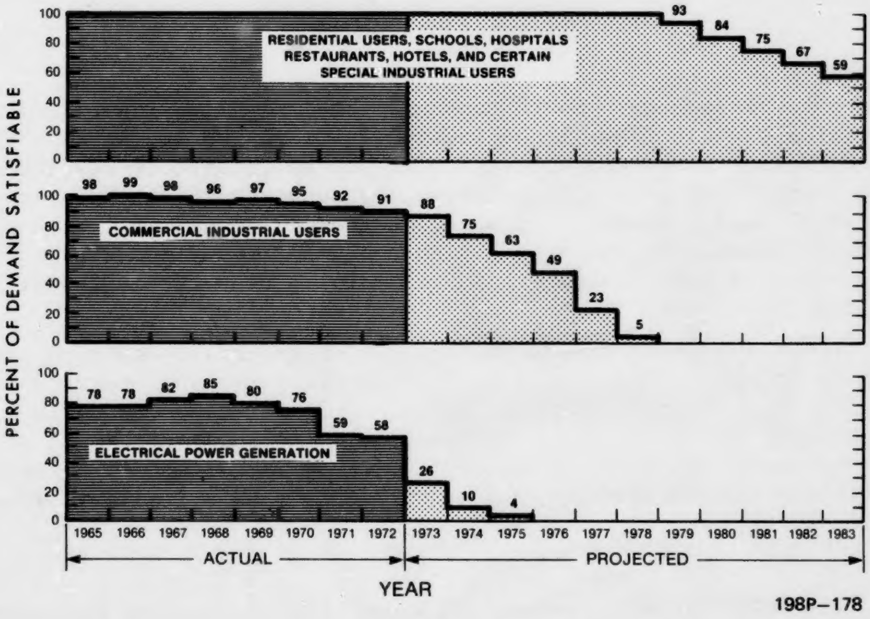


Figure II-110. Natural gas supplies to the Los Angeles region.

are expected to continue to decline until at least 1970. Then newly developed sources, as well as synthetic natural gas (SNG) from gasification projects, liquified natural gas (LNG) from Southern Alaska, North Slope Alaska, and Indonesia and possibly pipeline gas from Alaska, are expected to result in larger, more dependable gas supplies. The situation is complicated by uncertainties associated with new technologies and by trends toward the deregulation of natural gas. Residential, commercial, and small industrial users have the highest gas service priority. Larger industrial and commercial users with alternate fuel use capability have natural gas contracts subject to curtailment. For instance the use of natural gas by utilities in Los Angeles has been sharply curtailed in the last few years despite the desirability of burning such clean fuel (Arthur D. Little, Inc., 1975).

Political moves to increase allocations of natural gas to Southern California for use during critical air pollution conditions have been made, but the eventual outcome is as yet unknown (Fisher, 1976a). In order to come to grips with the natural gas problem, the State Public Utilities Commission may consider a ban on new gas service hookups and/or a rate structure that favors those who minimize gas usage (Fisher, 1976b). The role of natural gas in meeting future Los Angeles area energy needs is, at this time, highly uncertain.

4. POPULATION/DEMOGRAPHY

Population projection is a fundamental part of estimating future community wastewater systems needs. Accurate projections permit an efficient allocation of resources so that the potential for both excess supply with misallocated capital and excess demand with environmental degradation are minimized. Estimates of wastewater flows can be derived from population projections using standard allowances for commercial, industrial, and institutional flows that are added to established factors for residential flows to obtain per capita averages. The changing number and distribution of residents associated with service subareas serve as key variables in the development of alternate Scenarios with plant and collector system. These Scenarios, when subjected to cost effectiveness and environmental analysis, produce a viable alternative configuration that meets the needs of Los Angeles resident. This section describes Los Angeles population growth over time, both in its early growth phase and its more recent development, and presents the rationale behind future projections. Changes in distribution will be covered together with density of development and demographic characteristics. These data on growth rates and patterns can serve as part of the information base for examining how factors such as land use controls and public utilities may have influenced the size and/or distribution of past development. In addition, analysis of past growth is helpful in comparing alternate projections of future population change in the service area.

a. Regional Perspective. In 1975, the estimated population of the Hyperion Service Area was 3,053,429, and that of the Terminal Island Service Area was 114,174. For Los Angeles County, the estimated populaton was 7,020,772. Thus the two wastewater service areas cover about 45 percent of the total population of the County. Los Angeles County is part of a still larger area designated as the "Los Angeles-Long Beach-Anaheim Standard Consolidated Statistical Area" by the Bureau of the Census. This five-county area, including the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura, had an estimated 10,405,422 people in 1975 but is obviously dominated by Los Angeles County. The two wastewater service areas contain over 30 percent of the total population in this second-largest urban concentration in the country (Jamison, 1976).

b. Historical Development. With California's admission to the Union in 1850, the City had a population of only 1,610 people in a land area of 28 square miles (57.5 people per square mile) while the County's population was 3,530 people in a land area of almost 35,000 square miles (about 0.1 people per square mile). Both areas have increased dramatically in population and the City has expanded its land area to 460 square miles but the County was subdivided during the 19th century to form all or part of Orange, San Diego, San Bernardino, Ventura, and Kern Counties, and was left with a land area of 4,069 square miles. The 1975 population per square mile in the City was 6,005.6 and in the County 1,725.4 (Security Pacific National Bank, 1974).

Table II-42 shows the census count data for both the City and the County from 1850 to 1970 and the 1975 estimated population. Both areas have experienced substantial growth although the rates are not directly comparable since the County lost large land areas and the City gained smaller but still significant areas. Only during this disincorporation did the growth rate of the County outside the City fail to exceed the growth rate of the City. In both areas, growth rates prior to the Depression exceed those since both average annual growth rates continued to be high. In numbers of people, growth was very strong at least through 1970, for although the City's annual average growth rate fell to only 1.3 percent per year, this is the equivalent of 33,000 people, enough for most medium sized cities. And this low growth was occurring each year. The City's estimated decline for 1970 to 1975 is about 13,000 people per year.

The boundaries of the City of Los Angeles' wastewater system service area do not precisely follow established political boundaries. The area can be described approximately as the City itself plus the seven contract cities but with the "shoestring strip" and the Watts neighborhood deleted. The estimated 1975 population of the service area was 99.9 percent of the total population of the eight service cities, but precisely the same people are not included in the two groups. Growth in the contract cities since 1930 is shown in Table II-43. The decade of the thirties witnessed the worst depression in the nation's economic history, yet the aggregate of Los Angeles and the contract cities grew through immigration

Table II-42. Growth of Los Angeles City and County, 1850-1975.

YEAR	TOTAL POPULATION		ANNUAL AVERAGE GROWTH		
	LOS ANGELES CITY	LOS ANGELES COUNTY	LOS ANGELES CITY	LOS ANGELES COUNTY	NON-L.A. CITY COUNTY GROWTH (1)
1850	1,610	3,530	—	—	—
1860	4,385	11,333	17.2	22.1	26.2
1870	5,728	15,309	3.1	3.5	3.8
1880	11,183	33,381	9.5	11.8	13.2
1890	50,395	101,454	35.1	20.4	13.0
1900	102,479	170,298	10.3	6.8	3.3
1910	319,198	504,131	21.1	19.6	17.3
1920	576,673	936,455	8.0	8.6	9.5
1930	1,238,048	2,208,492	11.5	13.6	17.0
1940	1,504,277	2,785,643	2.2	2.6	3.2
1950	1,970,358	4,151,687	3.1	4.9	7.0
1960	2,479,015	6,038,771	2.6	4.5	3.9
1970	2,811,801	7,041,980	1.3	1.7	1.9
1975 (2)	2,746,234	6,992,299	-0.4	-0.1	0.1

(1) Computed for that portion of the county not inside Los Angeles City.

(2) Los Angeles County Department of Regional Planning Quarterly Bulletin No. 129, July 1, 1975. All other entries are Census data, summarized in Los Angeles County Regional Planning Commission, Quarterly Bulletin No. 98, October, 1967.

Table II-43. Population growth from 1930 to 1975.

CITY	1930	1940	1950	1960	1970	(JAN 1975)
Los Angeles	1,238,048	1,504,277	1,970,358	2,479,015	2,811,801	2,762,587
Beverly Hills	17,429	26,823	29,032	30,817	33,416	32,254
Burbank	16,662	34,337	78,577	90,155	88,871	83,126
Culver City	5,669	8,976	19,720	32,163	34,451	38,053
El Segundo	3,503	3,738	8,011	14,219	15,620	14,820
Glendale	62,736	82,582	95,702	119,442	132,664	132,821
San Fernando	7,567	9,094	12,492	16,093	16,571	15,565
Santa Monica	37,146	53,500	71,595	83,244	88,289	91,663
TOTAL	1,388,760	1,723,327	2,285,987	2,865,148	3,221,683	3,170,891

SOURCE: 1930-1970 Data Bureau, U.S. Department of Commerce, 1973 Census, California, 1970.

1 January 1975 Estimate Department of Regional Planning, County of Los Angeles, QUARTERLY BULLETIN No. 127, January 1975.

and expansion in film and oil industries. Growth from 1940 to 1950 was stimulated by the Pacific Theater of Operations during World War II. This was followed by a slowed rate of growth during the 1960 to 1970 decade, and, using the County's Regional Planning Department estimates for 1 January 1975, a decline of population estimated for the 1970 to 1975 time interval.

Table II-44 shows the more widely known population estimates for Los Angeles and the contract cities. While census data are the generally accepted baseline for historical and projected population levels, they cannot be considered completely accurate. Some people avoid enumeration and some census forms are either lost or destroyed (Seigal, 1974). Los Angeles has a large Spanish population and is proximal to the Mexican border making it likely that the City has a sizable population who would avoid all contact with governmental officials (such as census enumerators) for fear of being returned to their home country. The net effect of these factors is that the dicennial census generally undercounts the population. On a national level the undercount is about 1.9 percent of the total population, but for minorities it is larger; the undercount of blacks was about 7.7 percent. In general, the undercount is more serious for males, minorities, and low income persons. The Bureau of the Census has developed a means of estimating the national undercount but does not feel it is appropriate for smaller areas. However, the City has applied the

Table II-44. Population in 1970 and alternative estimates of population on 1 January 1975 for Los Angeles and contract cities.

CONTRACT CITY	CENSUS (1970)	STATE (1975)	COUNTY (1975)	CITY (1975)
Los Angeles	2,811,801	2,720,600	2,762,589	2,996,509
Beverly Hills	33,416	32,400	32,254	—(1)
Santa Monica	88,289	93,000	91,663	—(1)
Culver City	34,451	37,700	38,053	—(1)
El Segundo	15,620	15,400	14,820	—(1)
San Fernando	16,571	15,300	15,565	—(1)
Burbank	88,871	85,000	83,126	82,649
Glendale	132,664	132,700	132,821	136,599
TOTAL	3,221,683	3,132,100	3,170,891	3,413,112(2)

(1) Local projections not supplied by these cities.

(2) Total includes county estimates for Beverly Hills, Santa Monica, Culver City, El Segundo, and San Fernando.

federal model to Los Angeles to estimate an undercount in Los Angeles of almost 125,000 people (slightly less than the entire population of Glendale). While this technique is not generally accepted, it does indicate the magnitude of error that might be associated even with the census data. The revised estimate for Los Angeles is 2,936,753 people or 4.4 percent more than the count in 1970.

For interdicennial years even more uncertainty must be associated with reported population data since the production of the estimates is subject to policy decisions and several funding sources base the level of funding on estimated population. Table II-44 also contains three sets of estimated population for Los Angeles and the contract cities for 1 January 1975. The California Department of Finance, Population Unit and the Los Angeles County Department of Regional Planning, Population Research Section each supply estimates of all eight cities. Additionally, the cities of Los Angeles, Burbank, and Glendale generate local population estimates. Those by the City of Los Angeles include the 1970 undercount. The City has also generated an estimate not incorporating the undercount but for October 1975 rather than January 1975. This estimate is 2,824,828 people. The differences in estimated total population of the eight cities are fairly large. The DOF and the County differ by only about 40,000 people, but the cities and the DOF differ by over 280,000 people. Most of the difference is certered on the population of the City of Los Angeles and the incorporation or nonincorporation of the census undercount. There is no way, within the context of this report, to resolve these differences. Fortunately, the absolute size of the population within the error ranges model is not as important to facilities planning efforts as the relative distribution of population.

c. Distribution of Population. The broad changes in the geographical pattern of the City's growth can be seen in Table II-45. While the entire City of Los Angeles grew by a factor of 2.27 percent over the 40 years from 1930 to 1970, growth rates deviate from this norm in the subareas: Central Los Angeles grew by a factor of only 1.25 percent; Southern (Harbor) by a factor of 2.83 percent; West Los Angeles by a factor of 5.95 percent; and the San Fernando Valley grew by a factor of 17.8 percent.

The shift in population distribution within the geographic areas of Los Angeles is most dramatic when presented as in Table II-46. The San Fernando Valley contains almost half the land of Los Angeles but in 1930 housed only 4 percent of the people. By 1970, the Valley's share had increased to 34 percent of the people. This relative growth occurred at the expense of Central which had continued 17 of every 20 people in Los Angeles in 1930 and continues to house almost half the population. South remained constant in its share of the population, while West Los Angeles grew rapidly, but not at the rate of the Valley. The Valley and West continue to hold fewer people than their land share would indicate while Central holds more.

Table II-45. Historical population growth for the City of Los Angeles and contract cities (1930 to 1970) (Bureau of the Census, 1970).

CITY OR AREA	1930	% INCREASE	1940	% INCREASE	1950	% INCREASE	1960	% INCREASE	1970
San Fernando Valley	54,217	106.6	112,001	177.6	310,962	137.6	738,831	30.9	967,128
Central Los Angeles	1,070,007	13.8	1,218,186	9.4	1,333,304	-4.3	1,278,155	4.5	1,335,949
West Los Angeles	59,754	83.8	109,851	111.7	232,560	45.9	339,333	4.8	335,467
South Los Angeles	54,070	18.8	64,239	45.6	93,532	31.2	122,696	24.9	153,257
LOS ANGELES TOTAL	1,238,048	21.5	1,504,277	31.0	1,970,358	25.8	2,479,015	13.4	2,791,801
Beverly Hills	17,429	53.9	26,823	8.2	29,032	6.1	30.817	8.4	33,416
Santa Monica	37,146	44.0	53,500	33.8	71,595	16.3	83,249	6.1	88,289
Culver City	5,669	58.3	8,976	120.8	19,720	62.3	32,163	7.0	34,451
El Segundo	3,503	6.7	3,738	114.3	8,011	77.5	14,219	9.9	15,620
San Fernando	7,567	20.2	9,094	42.9	12,992	23.9	16,093	3.0	16,571
Burbank	16,662	106.1	34,337	128.8	78,577	14.7	90,155	-1.4	88,871
Glendale	62,736	31.6	82,582	15.9	95,702	24.8	119,442	11.1	132,664
CONTRACT CITY TOTAL	150,712	45.3	219,050	44.1	315,629	22.3	386,138	6.1	409,882
TOTAL LOS ANGELES AND CONTRACT CITY POPULATION	1,388,760	24.1	1,723,327	32.6	2,285,987	25.3	2,865,153	12.4	3,201,683

Table II-46. Share of total population and land by geographic zone of Los Angeles, 1930 and 1970.

GEOGRAPHIC ZONE	PERCENT OF LAND AREA	PERCENT OF POPULATION (1930)	PERCENT OF POPULATION (1970)
San Fernando Valley	47	4	34
Central	28	86	48
Western	19	5	13
Southern	6	4	5
TOTAL	100	99(1)	100

(1) Rounding error.

Detailed data on each of the 35 planning areas for 1975 and an indication of the 1970 baseline census data are shown in Table II-47 with summary information for the geographic zones highlighted in Table II-48. Population and population density in the Western and Southern areas remained relatively constant. Continued growth in the Valley was partially offset by decline in the Central area but on balance growth was experienced Citywide. Dwelling unit densities increased about 10 percent in both the Valley and Western areas and about 5 percent in the Southern area. Only Central experienced a decline in dwelling unit density, but the decline was less than 1 percent. The uneven growth of the geographic areas is even more obvious when the planning areas are examined. Over 60 percent of growth in the Valley occurred in only two planning areas: Chatsworth-Porter Ranch and Encino-Tarzana. Three Valley planning areas declined: Pacoima-Sun Valley, Sunland-Tujunga-Shadow Hills-Lakeview Terrace, and Sylmar. Three Central planning areas grew: Hollywood, North and East Central City, and Wilshire. Of the 35 planning areas, 15 declined and 20 grew. Over half of the declining areas are in the Central zone while half of the growing areas are in the San Fernando Valley.

The development of the Valley planning areas since 1930 is shown in Table II-49. The population is given together with persons per acre as a measure of density. Only Van Nuys and North Hollywood had densities of over 1 person per acre in 1930. By 1940 Sherman Oaks-Studio City had passed that mark, and by 1950 the Valley average had reached 2.2, although 5 of the areas still had less than 1 person per acre as late as 1950. By 1960 all the communities had developed beyond that point. The density levels of Table II-49 can be compared to the Citywide average of 9.57 people per acre.

Table II-47. Population 1970 and 1975 by planning area.(1)

COMMUNITY PLANNING AREA	POP. 1970	POP. 1975	CHANGE	POP/SQ MI	DU/ACRE
CENTRAL AREA					
Boyle Heights	75,926	73,751	-2,175	12,292	5.33
Central City	17,839	17,205	-634	4,916	3.47
Hollywood	156,335	157,982	1,647	6,345	5.18
North and East Central City	8,532	8,656	124	3,206	1.10
Northeast Los Angeles	183,852	178,501	-5,351	7,469	3.97
South Central Los Angeles	219,561	212,843	-6,718	13,732	7.42
Silverlake-Echo Park	66,557	66,363	-194	8,968	5.58
Southeast Los Angeles	185,788	175,957	-9,831	11,970	6.04
West Adams-Leimert Park-Baldwin Hills	159,090	154,337	-4,753	12,153	7.47
Westlake	67,473	65,708	-1,765	20,534	16.48
Wilshire	194,996	196,556	1,560	14,243	11.16
SUBTOTAL	1,335,949	1,307,859	-28,090	10,180	6.38
SAN FERNANDO VALLEY					
Canoga Park-Woodland Hills-Winnetka	130,694	134,172	3,478	4,915	2.31
Chatsworth-Porter Ranch	46,817	59,426	12,609	3,415	1.60
Encino-Tarzana	58,989	69,079	10,090	3,403	1.88
Granada Hills-Knollwood	53,270	57,266	3,996	3,389	1.52
Mission Hills-Panorama City-Sepulveda	104,325	104,786	461	6,986	3.50
North Hollywood	90,068	89,720	-348	8,883	5.92
Northridge	38,302	40,919	2,617	5,530	2.76
Pacoima-Sun Valley	100,071	97,550	-2,521	4,667	2.09
Reseda-West Van Nuys	78,918	80,715	1,797	6,783	3.55
Sherman Oaks-Studio City	76,859	78,451	1,592	5,230	3.75
Sunland-Tujunga-Shadow Hills-Lakeview Terrace	37,682	36,688	-994	2,265	1.11
Slymar	40,349	40,334	-15	3,151	1.38
Van Nuys	94,889	98,613	3,724	8,275	5.46
Verdugo Mountains	15,895	16,337	442	1,266	0.65
SUBTOTAL	967,128	1,004,056	36,928	4,651	2.49
WESTERN AREA					
Bel Air Beverly Crest	17,672	17,895	223	1,177	0.71
Brentwood-Pacific Palisades	53,703	54,283	580	1,432	0.93
Palms-Mar Vista-Del Rey	94,346	97,073	2,727	12,134	8.05
Venice	36,146	36,311	165	11,347	7.90
Westchester-Playa del Rey	54,133	49,815	-4,348	3,832	2.30
Westwood	33,770	35,435	1,665	9,086	6.22
West L.A.-Century City-Rancho Park	65,667	64,833	-834	9,131	6.87
SUBTOTAL	355,467	355,645	178	4,032	2.70
SOUTHERN AREA					
San Pedro	70,249	72,587	2,338	7,116	3.43
Torrance-Gardena Corredor	31,861	31,446	-415	6,217	3.12
Wilmington-Harbor City	51,147	53,235	2,088	4,003	1.95
SUBTOTAL	153,257	157,268	4,011	5,522	2.67
TOTAL CITY	2,811,801	2,824,828	13,027	6,126	3.62

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(1)Department of City Planning, 1976.

Table II-48. Population and housing density by geographic areas of Los Angeles, 1970 and 1975.

GEOGRAPHIC AREA	POPULATION		POPULATION PER SQUARE MILE		DWELLING UNITS PER ACRE	
	1970	1975[1]	1970	1975	1970	1975
Valley	967,128	1,004,056	4,480	4,651	2.26	2.49
Central	1,335,949	1,307,859	10,400	10,180	6.43	6.38
Western	355,467	355,645	4,030	4,032	2.44	2.70
Southern (Harbor)	153,257	157,268	5,381	5,522	2.54	2.67
City	2,811,801	2,824,828	6,098	6,126	3.47	3.62

[1] Department of City Planning, 1976; and Department of City Planning, 1974.

d. Demographic Summary. Table II-50 presents several demographic characteristics for Los Angeles area communities. Growth ranges from high growth rates in Los Angeles and Glendale to a low rate in the City of San Fernando and a loss in Burbank. Nationally, the 1960 to 1970 growth rate was 13.3 percent, but in central cities it was only 6.4 percent (Bureau of the Census, 1973). The Hyperion Service Area demonstrates low density factors when compared with urban centers such as New York City (26,343 people per square mile), Chicago (15,126), or San Francisco (15,764). Low density is characteristic of other California communities such as San Diego (2,199), San Jose (3,273), or Long Beach (7,364) (Bureau of the Census, 1973). Although family size varies among communities, all except Los Angeles approximate the national average of 3.62 people per family. Median age in service area cities is higher than the national average of 28.1 years.

Although median income for the cities in the service area approximates that for California ($10,729), they exceed national levels of $9,586 (Bureau of the Census, 1973). In addition to median family income, the distribution of family income by income size provides a more graphic representation of relative affluence. Table II-51 shows these data for Los Angeles and the contract cities as it was estimated in 1970. By far, the highest median income is in Beverly Hills where almost 40 percent have family incomes over $25,000 per year and fewer than 10 percent have incomes under $5,000. At the other extreme is San Fernando with fewer than 4 percent in the highest category and almost 25 percent have incomes under $5,000. The other service cities distribute between these extremes.

The structure of the labor force in Los Angeles and the contract cities in terms of occupational distribution in 1970 is displayed in Table II-52. The City of Los Angeles data are given by geographic subareas as well, and information is given by place of residence rather than place of employment. Some differences among the cities are apparent. Beverly Hills and Santa Monica have large proportions of

Table II-49. Population of San Fernando Valley planning areas (1930-1970).

PLANNING AREA	ACRES	PERSONS/(PERSONS PER ACRE)					
		1930	1940	1950	1960	1970	1975
Sherman Oaks-Studio City	9,575	7,484 (0.8)	21,529 (2.2)	44,322 (4.6)	65,593 (6.8)	76,859 (8.0)	78,451 (8.2)
North Hollywood	6,494	9,484 (1.5)	21,856 (3.4)	57,250 (8.8)	81,172 (12.5)	90,008 (13.9)	89,720 (13.9)
Pacoima-Sun Valley	13,407	6,010 (0.4)	11,375 (0.9)	44,141 (3.3)	83,339 (6.6)	100,071 (7.5)	97,550 (7.5)
Van Nuys	7,491	8,205 (1.1)	15,336 (2.0)	42,046 (5.6)	79,893 (10.7)	94,889 (12.7)	98,613 (13.2)
Mission Hills-Panorama City-Sepulveda	9,607	4,362 (0.4)	7,431 (0.8)	26,790 (2.8)	79,825 (9.6)	104,325 (10.9)	104,786 (10.9)
Verdugo Mountains	8,239	1,130 (0.1)	2,550 (0.3)	6,785 (0.8)	12,227 (1.5)	15,895 (1.9)	16,337 (2.0)
Sylmar	8,183	2,069 (0.2)	3,249 (0.4)	9,427 (1.2)	25,644 (3.1)	40,349 (4.9)	40,334 (4.9)
Granada Hills-Knollwood	10,802	843 (0.1)	1,411 (0.1)	4,186 (0.4)	27,717 (2.6)	53,270 (4.9)	57,266 (5.3)
Canoga Park-Winnetka-Woodland Hills	17,479	3,852 (0.2)	5,397 (0.3)	12,866 (0.7)	80,599 (4.6)	130,694 (7.5)	134,172 (7.7)
Chatsworth-Porter Ranch	11,161	1,050 (0.1)	2,091 (0.2)	4,717 (0.4)	21,837 (2.0)	46,817 (4.2)	59,426 (5.3)
Northridge	4,755	1,011 (0.2)	1,425 (0.3)	4,166 (0.9)	21,948 (4.6)	38,302 (8.0)	40,919 (8.6)
Reseda-West Van Nuys	7,608	2,716 (0.4)	5,747 (0.8)	20,932 (2.8)	74,825 (9.8)	78,913 (10.4)	80,715 (10.6)
Encino-Tarzana	12,982	1,793 (0.1)	4,589 (0.4)	18,043 (1.4)	38,678 (3.0)	58,989 (4.5)	69,079 (5.3)
Sunland-Tujunga-Shadow Hills-Lakeview Terrace	10,390	3,784 (0.4)	7,463 (0.7)	15,571 (1.5)	29,238 (2.8)	37,682 (3.6)	36,688 (3.5)
VALLEY TOTALS	138,173	53,798 (0.4)	112,001 (0.8)	311,242 (2.2)	739,045 (5.3)	967,128 (7.0)	1,004,056 (7.3)

Table II-50. Demographic profile of service area cities (Bureau of the Census, County and City Data Book, 1972).

CHARACTERISTIC	CITY								TOTAL
	LOS ANGELES	GLENDALE	BURBANK	SANTA MONICA	BEVERLY HILLS	CULVER CITY	SAN FERNANDO	EL SEGUNDO	
1970 Population (#)	2,811,801	132,664	88,871	88,289	33,416	34,451	16,571	15,620	3,221,683
1960-1970 Change (%)	13.4	11.1	-1.4	6.1	8.4	7.1	3.0	9.9	12.4
Land Area (sq mi)	463.1	29.4	17.1	8.3	5.7	4.8	2.4	5.4	536.2
Density (pop/sq mi)	6,333	4,512	5,197	10,637	5,862	7,177	2,893	2,893	6,008
Housing Units (#)	1,074,173	56,455	35,963	42,106	15,092	13,075	5,994	5,994	1,248,417
Occupancy (%)	96.3	97.3	97.4	96.8	97.9	95.9	NA	NA	NA
Household Size (#)	2.68	2.40	2.55	2.14	2.28	2.75	3.02	2.71	NA
Family Size (#)	4.25	3.63	3.52	3.88	3.61	3.63	3.02	2.71	NA
Non-White (%)	22.5	1.6	1.2	6.7	1.5	4.6	3.6	1.0	20.0
Median Age	30.5	37.0	34.6	37.5	46.9	33.1	28.5	78.5	NA
Under 18 Years (%)	29.5	24.8	26.2	19.8	19.2	29.0	33.8	33.2	NA
Over 65 Years (%)	10.5	15.6	10.4	16.5	19.9	8.1	11.4	5.8	NA

Table II-51. Distribution of family income by class intervals, 1970 (Bureau of the Census, County and City Data Book, 1972).

ANNUAL FAMILY INCOME	PERCENT								TOTAL
	LOS ANGELES	BEVERLY HILLS	BURBANK	GLENDALE	CULVER CITY	SANTA MONICA	SAN FERNANDO	EL SEGUNDO	
Less than $3,000	9.2	5.4	4.9	6.0	5.6	7.6	10.9	3.5	8.8
$3,000-$4,999	9.5	4.1	6.9	7.7	5.5	8.4	12.5	5.1	9.2
$5,000-$6,999	10.7	5.4	10.2	9.0	6.6	11.4	12.9	7.3	10.6
$7,000-$9,999	17.5	8.7	17.8	17.4	16.2	18.0	20.9	16.3	19.5
$10,000-$14,999	24.9	14.5	30.3	27.6	32.5	25.4	23.5	30.3	25.3
$15,000-$24,999	20.1	22.5	24.1	23.8	25.3	21.1	15.5	29.9	20.7
Over $25,000	8.0	39.4	5.8	8.5	8.3	7.9	3.8	6.7	8.3
Median Income	$10,530	$20,303	$11,501	$11,651	$12,184	$10,787	$8,803	$12,433	NA
Number of Families	694,719	9,252	25,245	36,620	8,647	22,734	4,099	4,147	805,463

Table II-52. Occupational aspects of the service area labor force by place of residence (Bureau of the Census, County and City Data Book, 1972).

OCCUPATION	LOS ANGELES CITY					BEVERLY HILLS	BURBANK	CULVER CITY	GLENDALE	SAN FERNANDO	SANTA MONICA	EL SEGUNDO	TOTAL
	CENTRAL	VALLEY	WESTERN	SOUTHERN	TOTAL								
Professional, Technical, and Kindred Workers	14.3	20.3	27.6	11.0	18.1	24.7	17.2	17.3	18.2	9.6	23.3	17.7	18.3
Managers and Administrators, Except Farm	7.0	11.5	12.4	6.2	9.3	23.2	9.8	10.7	11.8	6.4	9.4	7.5	9.6
Sales Workers	6.4	9.9	9.7	5.4	8.0	14.9	8.0	8.5	8.4	4.8	8.4	5.7	8.1
Clerical and Kindred Workers	23.9	20.1	21.5	17.5	21.9	18.5	23.4	23.7	25.1	14.4	23.4	25.0	22.1
Craftsmen, Foremen, and Kindred Workers	9.9	12.8	8.4	15.2	10.9	3.6	14.3	14.1	11.2	15.7	9.5	16.0	11.0
Operative, Except Transportation	15.4	9.6	6.6	19.9	12.3	2.0	12.1	11.1	9.3	24.0	8.3	12.9	12.0
Transportation Equipment Operatives	3.2	2.3	1.5	3.7	2.7	0.7	2.7	2.4	2.3	3.0	1.8	1.0	2.6
Laborers, Except Farm	4.4	3.2	2.7	8.6	3.9	1.1	2.9	3.0	3.0	7.9	3.2	2.8	3.8
Farmers and Farm Managers	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1
Farm Laborers and Farm Foremen	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.9	0.1	0.0	0.1
Service Workers Except Private Households	13.2	9.5	8.0	11.3	11.1	4.8	8.9	8.3	10.0	12.0	11.1	11.1	10.9
Private Household Workers	2.1	0.7	1.3	0.9	1.5	6.4	0.6	0.6	0.8	1.4	1.4	0.5	1.5
TOTAL	100.0	100.1	99.9	100.0	99.9	100.0	100.0	100.0	100.2	100.1	99.9	100.2	100.1
TOTAL LABOR FORCE	534,925	398,280	165,814	51,308	1,150,392	14,656	41,262	14,516	60,036	6,038	40,949	7,513	1,446,463

Professionals and Beverly Hills also has a large share of Managers, Sales Workers, and Private Household Workers. San Fernando tends to be below average on Professionals, Managers, Sales Workers, and Clerical, while above average for Operatives and Laborers. The other cities are not distinguished in terms of occupational concentrations. Within Los Angeles, Professionals and Managers are most concentrated in the Western zone. Craftsmen, Operatives, and Laborers are disproportionately located in the Southern zone. In terms of occupational distribution, the Valley generally resembles the overall City.

e. Population Projections. Population growth constitutes demand for residential, commercial, and service activities, and wastewater treatment is one important service. Population projections for the City of Los Angeles have been proposed by several agencies involved in estimating future requirements for community services.

The State Water Resources Control Board has found population projections to be the single most important item of all criteria in coordinating comprehensive water quality management plans in California. It is not possible to accurately specify future population growth over a twenty-five year period due to rapid and dramatic changes that can occur in such factors as the number of births per year per 1000 females (fertility rate) which has been at its lowest level during the early 1970s, state inmigration, which is dependent upon national factors including such items as overall national affluence, governmental expenditures, and retirement preferences, and state intramigration which may be in response to multiple variables including employment opportunities. However, even when the fertility rate, state inmigration, and state intramigration have been estimated and the population increments allocated to the City of Los Angeles, the locational decisions within the City will be major factors in assessing the pressures to be placed on the sewage system at specific locations. Despite the uncertainties involved, estimates can be generated that are based upon past and current experience and that establish a range of reasonable alternative growth profiles. Local policies toward encouraging industrial or manufacturing employment centers can take into consideration community services, including transportation, fire and safety, and wastewater treatment capacity, and tailored all efforts toward meeting the local population goals. The setting and implementing of such goals and community policies will have various effects upon the local environment. For example, regarding land use, certain communities may prefer to retain mountainous areas as open space for aesthetic purposes or due to fire danger but may have to give up productive agricultural land to residential and commercial uses in exchange. In another case, regarding air quality, it is not the absolute population that is critical to emittants produced by mobile sources and resultant air pollution but rather the distribution of that population and proximity to employment and commercial areas used by the population. Thus the residents of high rise condominiums near combined employment and commercial centers would be expected to produce considerably fewer pollutants than a smaller number of residents distributed in single family detached housing distant from both commercial and employment opportunities. Nevertheless, the concentrated population may place increased demands upon police and fire services and may also be very high cost residences due to property assessments and construction procedures. And efforts to curtail population growth through limitations on the supply of community services such as water availability or wastewater treatment, while not concurrently limiting economic opportunities that encourage population growth, will create pressures upon existing housing, transportation, and community services and potentially encourage development beyond the political boundaries and beyond the control of local decisionmakers. Thus the community decision regarding the choice of a population growth policy is intimately tied to all planning, including land use and wastewater treatment facilities.

Population projections appropriate to the Facilities Plan are those that have been prepared for the City of Los Angeles by the California Department of Finance (DOF) and the Southern California Association of Governments (SCAG). For the Hyperion Service Area, these are given in Table II-53. Each projection scenario reflects a particular combination of assumptions regarding birthrates, death rates, and net migration.

An additional constraint regarding population projections for the Facilities Plan of the City of Los Angeles is the determination by the State Air Quality Resources Board that the City is within an "air critical" area. This determination requires that particular care be taken to insure that State Water Resources Control Board grants do not provide for growth with resultant further detrimental effects upon air quality. The State Air Quality Resources Board requires that wherever an area is designated "air critical" only population projections based on birthrate "E" with an annual rate of 2.1 births per women during her child-bearing years and a net state inmigration of zero be used to project wastewater flows for funding grants. This E-0 birthrate projection, prepared by the California

Table II-53. Population estimates for the subareas within the Hyperion System used in the Facility Plan Projection.

SYSTEM SUBAREA	SUBAREA COMPONENT	1970 CENSUS	1975 CENSUS	PROJECTED					
				1980		1990		2000	
				DOF E-O 1974	SCAG-76 1975	DOF E-O 1974	SCAG-76 1975	DOF E-O 1974	SCAG-76 1975
San Fernando Valley	Sepulveda	643,000	665,674	619,061	678,379	608,060	724,081	616,521	758,533
	MOS-LCSFVRS Tunnel	339,414	339,085	322,467	346,785	309,782	365,999	309,053	383,405
LAGWRP	Los Angeles	5,752	6,225	5,813	6,129	5,512	6,228	5,320	6,313
	Glendale	103,271	101,040	97,242	103,483	94,176	107,618	92,036	112,154
	Burbank	87,716	88,198	84,952	87,921	79,260	87,685	77,094	87,553
	La Crescenta	21,800	22,640	21,408	23,479	20,448	25,157	20,100	26,823
HTP (direct)		1,887,647	1,830,567	1,745,273	1,846,230	1,662,564	1,931,457	1,607,978	1,988,962
Total Hyperion System		3,088,600	3,053,429	2,896,216	3,092,406	2,779,802	3,248,225	2,728,102	3,363,743

State Department of Finance and the SCAG-76 projection, have been used in both the Facilities Plan and the EIS. Strict adherence is required in planning population growth restrictions to insure that the goals of the City as a whole are reflected in all planning efforts.

Although the two projections do not differ significantly in the distribution of population (each forecast about 23 percent in the Sepulveda subcomponent area by 2000 and 59 percent in the HTP direct subcomponent area), they differ dramatically in total population and the direction of growth. DOF E-0 forecasts a net loss of population from 1970 through 2000 while SCAG-76 forecasts growth. In 1980, DOF forecasts are 94 percent of SCAG forecasts; by 1990 they are 85 percent; and by 2000 only 81 percent. DOF forecasts the HTP service area to decline by 12 percent over 30 years while SCAG forecasts a 9 percent increase. That the two data sets do not differ in their distributions is a function of how the distributions were prepared. That they do differ in the total future populations is a function of the underlying assumptions used in the projections.

Three considerations are appropriate to population projections such as these: natural increase (the net of births minus deaths), migration (the net of inmigration minus outmigration), and policy considerations that allocate the total projected population to appropriate subareas. Table II-54 shows estimated annual increase, births, deaths, and imputed net migration for the City of Los Angeles.

Between 1960 and 1964, Los Angeles experienced about 55,000 births per year, but by the last five years listed in Table II-54 the absolute number of births had declined to about 48,500. The birthrate

Table II-54. Population dynamics of the City of Los Angeles (1960-1972).

YEAR	ESTIMATED ANNUAL INCREASE	BIRTHS	DEATHS	NATURAL INCREASE	IMPUTED NET MIGRATION
1960	32,452	55,158	25,503	29,655	2,797
1961	30,395	55,660	25,594	30,066	329
1962	34,060	54,905	25,722	29,183	4,877
1963	40,000	54,938	26,206	28,732	11,268
1964	38,373	54,245	26,202	28,093	10,280
1965	36,432	52,271	26,280	25,991	10,441
1966	32,684	51,801	27,420	24,381	8,303
1967	44,464	50,033	26,656	23,377	21,092
1968	32,623	50,161	26,270	23,891	8,732
1969	14,326	51,973	27,349	24,624	(-10,298)
1970	11,831	52,592	26,565	26,027	(-14,196)
1971	16,073	45,592	26,432	19,160	(-3,087)
1972	3,324	41,905	25,862	16,043	(-12,719)

SOURCE: Department of City Planning, 1975.

(births per 1,000 population) in Los Angeles, as nationally, has been declining for some time. In Los Angeles the 1960 birthrate was 22.0, but by 1972 this had dropped to 14.7. While temporary reversals in this trend have occurred if annual data are examined, the general trend in birthrate is down (Department of City Planning, 1975). Fertility is the major long-term determinant of population growth and therefore population projections are particularly vulnerable to variations in fertility rates. While birthrates can be computed for any population group and historic time period, fertility rates are computed as the number of children a woman will have (on the average) by the completion of her child-bearing period which is typically assumed to be ages 14 to 49, inclusive. Thus, fertility rates for a group of active women must be estimated. The Bureau of the Census supplies several projected fertility rates to be used in population projections. Those most commonly in use currently include:

Series C	2.8
Series D	2.5
Series E	2.1
Series F	1.8
Series G	1.5

Series E projections are generally considered the equivalent of zero population growth although the current age structure of the national population is such that zero population growth at Series E fertility rates would not occur until approximately the third decade of the 21st century (the "baby boom" post-war era women are currently of childbearing age). Series E is slightly greater than 2.0 to allow for infant and childhood mortality and persons who never become parents. If fertility rates remain constant, the increased number of potential parents would result in a secondary increase in the birthrate.

As shown in Table II-54, the birthrate has declined rather than increased. Two factors appear operative in this decline. First, we are in a period of gradually rising age at childbearing. This effect is temporary since age at childbearing cannot rise indefinitely. When it stabilizes, the birthrate will rise unless offset by changes in fertility. Among the factors suggested to explain the rising age at childbirth are recent adverse economic conditions and improved family planning techniques. The second, and more important, factor in the declining birthrate is a decline in fertility rates for age cohorts. Comparison of 1967 and 1972 sample survey data on married women aged 18-24 show the former anticipate 2.9 children while the latter anticipate only 2.3 children. Assuming a lower fertility rate for unmarried women in the age cohort projects 2.6 children for women in the 1967 sample and 2.1 in the 1972 sample. On the average, women in their late thirties already have more than three children (SCAG, 1973). The lowest completed cohort fertility ever recorded in the United States was 2.45 births per woman for those women born in the years 1905-1910 and thus in their prime childbearing years during the Depression and the Second World War. For comparison, women born during 1925-1930 averaged half again as many children and produced the post-war baby boom.

Unlike birthrates, mortality rates can be anticipated fairly accurately since they are not based on individual decisions. Advances in medical technology are slowly advancing average life expectancy, but mortality rates are more constant than birth rates. As shown in Table II-54, the number of deaths in Los Angeles has increased only slightly over the time interval. Because the base population was also increasing, the mortality rate (deaths per 1,000 population) declined from 10.2 in 1960 to 9.1 in 1972).

The second major component of population projections, migration, is if anything more difficult to project than birthrates. While the total proportion of movers has remained fairly constant nationwide (ranging between 18 and 21 percent from 1950 to 1974), their origins and destinations have varied widely and the variation increases as the study area decreases. About two-thirds of those who move in any year relocate within the same county. Of the remainder, about half move to another county within the same state and half move to a new state. Traditionally, a disproportionate share of these interstate movers have relocated to California. During the mid-1940s (the war years), inmigration to California reached 500,000 people per year and leveled off at about 300,000 people annually from 1956 to 1964. From 1970 to 1972, the Department of Finance reported net in-migration of 15,000; 44,000; and 55,000. The six county SCAG region, from 1965 to 1970, had been receiving about 180,000 inmigrants per year from other states and a like number from other California counties (SCAG, 1973).

Until recently, Los Angeles has been the destination of most of these inmigrants, but this trend is expected to reverse (and perhaps already has) as indicated in Table II-54. The primary reasons for this reversal are:

(1) Los Angeles is the older center of a megalopolis which includes newer and outlying metropolitan areas;

(2) Population composition favors more rapid natural increase in outlying areas than Los Angeles;

(3) Newer metropolitan areas are also growing due to their attraction for migrants (Berg and Van Arsdol, 1975);

(4) While Los Angeles is a center of economic, social, and political integration for Southern California, much economic activity is decentralizing to surrounding areas;

(5) The outlying areas of Orange, San Bernardino, Riverside, Ventura, Santa Barbara, and San Diego are rapidly urbanizing.

An indication of these intrastate relocations is shown in Table II-55. Data in the table indicate only those paried counties of California with an annual gross of at least 3,000 drivers license exchanges. Although the table therefore does not include all the intercounty migration, it does include the majority of the migration. Even from these partial data, Los Angeles County lost almost 125,000 per year to other California counties.

Table II-55. Comparison of six-county population allocation, 1990 (DOF, 1974; SCAG, 1975a and 1975b).

COUNTY	DOF D-100	SCAG (JUNE)	SCAG (DEC)
Los Angeles	7,346,800	7,555,000	7,557,000
Orange	2,465,300	2,337,000	2,369,000
San Bernardino	913,800	912,000	867,000
Riverside	755,500	728,000	728,000
Ventura	704,400	653,200	632,000
Imperial	101,800	102,000	102,000
TOTAL	12,287,600	12,287,200	12,255,000

If the national averages apply to California, these intercounty outmigrants were matched by an equal number who moved to other states. The movement from Los Angeles County to other Southern California counties is apparent in Table II-55 as over 80 percent of the identified outmigration stays within the region.

The outmigration stream is only partially affected by inmigration from other California counties. About 63,000 Californians moved annually to Los Angeles while 125,000 Los Angelenos moved to other areas or parts of California. About two-thirds of the identified inmigrants are from other Southern California counties, thus replacing less than half of the loss to those same counties. From Northern California the attraction of Los Angeles offsets about 70 percent of the outmigration. With no county that Los Angeles is exchanging population does the stream favor Los Angeles. These trends support the contentions above of decentralization of the Central City (Berg and Van Arsdol, 1975).

The DOF estimates population levels for the state based on fertility assumptions and net statewide migration. Several population projections are provided based on alternative paried assumptions of C, D, or E fertility rates and net inmigration of 150,000, 100,000, or 0 people per year. The four population scenarios are described in terms of these assumptions as C-150, D-150, D-100, and E-0. For example, E-0 (read: E-zero) means Series E fertility rates and zero net migration are the major assumptions. The projected statewide populations for 1 July 2000 are:

C-150	31,870,000
D-150	30,489,000
D-100	29,277,000
E-0	24,746,000

Series D-100 is the baseline case. Statewide projections are then allocated to counties based on age composition of the migrant population implied from the 1960 to 1970 experience, the census question on residence five years earlier, and drivers license change of address forms received by DMV. These factors are also conditioned by the knowledge of local planners and state and federal analysis in the fields of water, land, transportation, and environmental questions (Department of Finance, 1974).

SCAG does not generate projections but rather reallocates the DOF projections within their six-county study area. Table II-55 presents DOF and SCAG population allocations for the SCAG region. The DOF D-100 and SCAG June 1975 totals are almost identical. They differ in that SCAG was using a February DOF data set that was subsequently revised upward slightly. For the final SCAG allocation of December 1975 (the official SCAG-76 allocation), SCAG planners attempted to resolve DOF projections with local projections resulting in an overall decline in projected population.

The redistribution of population by SCAG is based on a series of policy considerations. These policies are:

- Encourage growth in and adjacent to existing urban areas.
- Avoid excessive housing recycle and resulting community disruption.
- Avoid densities that would overtax the existing and currently planned infrastructure.
- Preserve, whenever possible, the region's natural resources and desirable land uses, particularly prime agricultural lands.
- Balance population with jobs within each major subregion.
- Support the policies of SCAG's Regional Transportation Plan.

The DOF E-0 and the SCAG-76 data listed in Table II-55 for the Hyperion Service Area are both allocations of the DOF projections using SCAG's policy considerations. The DOF prepares only statewide projections and from these allocates only to the county level. SCAG does not prepare projections but does take DOF's allocation of their statewide projection for the six-county SCAG region and redistributes the population based on local understanding of developmental prospects and preferences. The SCAG-76 allocations are based on the DOF D-100 series although redistribution of population resulted in a small net drop of the six-county future population. The SCAG allocation to subregion (RSA) procedures were also used to redistribute the DOF allocations to the six-county area from the DOF E-0 projections. Although the two data sets of Table II-56 are labeled DOF E-0 and SCAG-76, both were initially prepared by DOF (under the D-100 or the E-0 assumptions) and both were reallocated to RSA's by SCAG procedures. The nomenclature DOF E-0 and SCAG-76 is misleading but retained in this report since the labels are generally accepted if poorly understood.

Table II-56. Percentage of employment by sector-city of Los Angeles and five contract cities (Bureau of the Census, County and City Data Book, 1972).

	CITY OF LOS ANGELES	BEVERLY HILLS	BURBANK	GLENDALE	CULVER CITY	SANTA MONICA
Manufacturing	24.0	10.5	30.4	22.3	25.4	21.0
Trade	20.7	24.3	20.4	21.1	21.5	19.4
Services	10.7	15.2	8.0	8.8	7.9	11.5
Educational Services	6.6	5.4	5.1	5.5	6.4	8.5
Construction	3.9	3.4	3.8	4.3	5.1	3.2
Government	14.1	6.5	11.3	11.9	12.5	15.2
Employment Factor	1,150,796	14,646	41,262	60,036	14,516	40,949

f. Economics and Employment. Economic factors that contribute to demand for residences within the City of Los Angeles include the level of employment and the level of income. The employment opportunities in Los Angeles County have remained relatively stable since the 1970 census data, given in Table II-56. These data give percentage of employment by the six major employment sectors for Los Angeles and the five major contract cities with tributary flows that affect the Facilities Plan. The City of Los Angeles is the dominant employer in the region with all of the other cities together having fewer than 15 percent of the total employment opportunities in Los Angeles. In percentage terms, the City of Beverly Hills stands out as a trade and services center, since the City capitalized on trade and services during the heyday of Hollywood. Proportionately, Burbank (the home of Lockheed) is a manufacturing center, Santa Monica has a higher number of Government and Education Services, and Glendale, the second largest employment center of the group, has a mix nearly identical to Culver City, the smallest employment center. The employment similarity among cities in the area identifies a difficult Facilities Plan issue. The control of point source water pollutants is important to minimizing adverse constituents to wastewater that require special treatment or that could be concentrated in biological organisms, including man. Where employment in manufacturing or industry is concentrated in one community, such as manufacturing centers of Pittsburgh or Detroit, the focusing of policies and controls to meet water quality standards is facilitated. However, in the Los Angeles Basin the major factor that faces planning for point source controls is the fact that these sources are, quite literally, scattered throughout each community and concurrently scattered within the communities.

A review of Figure II-72 with the industries in blue shows some concentration of industry and commercial activity near the Central City and growing industry in several areas throughout the San Fernando Valley. This diverse location of industry highlights the problem for Los Angeles. Although existing land uses for the contract cities are not plotted, a comparison with Table II-56 employment by sector for each contract city suggests a similar distribution to that of Los Angeles, except on a proportionately smaller scale.

These concentrations of employment centers draw workers from within the City and from surrounding communities. In 1970, Los Angeles City had nearly 1,130,000 jobs and 975,000 workers. Slightly fewer than 700,000 of the workers who resided in the City were also employed in the City. Thus, the City of Los Angeles daily exported 275,000 workers to surrounding areas and imported 430,000 workers from neighboring cities and county jurisdictions. The daily migration of over 700,000 employees results in a net importation for the City of Los Angeles of over 150,000 workers.

The City of Los Angeles was the destination of one-third of all Southern California workers who left their home jurisdictions to work in some part of Los Angeles County. In many instances these workers are concentrated on the periphery of the City of Los Angeles. In the 1975 Special Census for Ventura County, for example, the Simi Valley was then found to send over 66.1 percent of its workers or nearly 10,000 persons to the City of Los Angeles daily. Slightly over 46.1 percent or nearly 6,000 of the workers in Thousand Oaks, eastern Ventura County, also commute to the City of Los Angeles daily. Those factors which contribute to rising family incomes, including expanded employment opportunities, and improved national economy, and increased demand for goods manufactured in Los Angeles also contribute to intracity migration outward and physically upward from the Los Angeles downtown area.

This relationship of employment to residential location contributes to the trans-Santa Monica Mountains commute pattern. In addition, the daily migration of employees to and from the City of Los Angeles adds to the traffic congestion. The daily net inmigration of workers to the Hyperion Service Area, confined with a higher concentration of industrial and commercial activities than would exist without the bedroom communities, produces higher per capita flow rates of sewage than would otherwise be anticipated. This migration creates difficulties in the estimating of wastewater flows and the planning for sewer outfalls and treatment facilities within the Hyperion Service Area.

5. TRANSPORTATION

a. Existing Highway and Transit Systems.

(1) INTRODUCTION. A well-developed transportation network provides access to housing, employment, and retail centers, and is an important factor in shaping the urban form. A transportation system is one of many factors that determines how intensely an area may be developed. Until 1880 time and energy costs discouraged travel, and semi-self-contained villages developed in the Los Angeles region. The introduction of railroads into the region strengthened the early settlements and encouraged settlement specialization. The subsequent interurban transit cars stimu-

lated development in the open areas between the routes with the population settling along the lines. These interurbans were replaced by highways that reinforced the pattern.

After 1920 the automobile began to play a larger role in the development of the region. The linkages provided by this system served to open outlying areas to population migration and new urban development. Cheap land available in outlying areas combined with post World War II Federal housing policies encouraged the single-family house in the suburban setting.

From a historical perspective, the Pacific Electric Interurban Railway System significantly influenced the basic form and expanse of the Los Angeles region until the early 1950s, while the first generation freeway system developed in the 1950s and 1960s facilitated a significant expansion. Figure II-111 illustrates how urbanization and transportation improvements developed. While it is generally agreed that the development of major transportation networks has historically been a significant contributor to changes in regional land use patterns and growth potential, there is no such agreement as to whether it continues to do so. Decentralizing forces at work in the urban areas, once begun, have become so powerful as employment, commercial, and educational centers relocate to the suburbs that transportation cannot do more than serve these forces.

(2) EXISTING SYSTEMS. The California Department of Transportation (Caltrans) has the responsibility to plan, budget, build, and maintain the State Highway System (which in Los Angeles County consists principally of freeways). The City of Los Angeles has the responsibility to plan, construct, and maintain major and secondary highways and local streets within the City. Alignments of local streets are planned in conjunction with the subdivision or renewal of local areas. Detailed proposals for the highway system are prescribed by the Highway and Freeway Technical Element of the Los Angeles General Plan. Funding is primarily provided from monies derived from gas tax as allocated by the state to the City, both directly and through Los Angeles County (Department of City Planning, 1970).

The vehicular system has always been considered the most important component of the entire transportation system in Los Angeles. The existing freeway network in the Los Angeles region was developed after the California Legislature established the California Freeway and Expressway System in 1958 to handle future transportation needs which could not be met by the surface highways and street system. Simultaneously, the Gas Tax Fund, established to tax motor vehicle users, was instituted to help finance and implement the system (Collier-Burns Bill, 1948). Figure II-112 shows the primary surface streets and completed freeways in Los Angeles. The Los Angeles area network represents a $3.5 billion current dollar investment, although in 1976 dollars it would require nearly $10 billion to duplicate the system (Hebert, 1976). Table II-57 summarizes the constructed state freeway mileage in the City of Los Angeles.

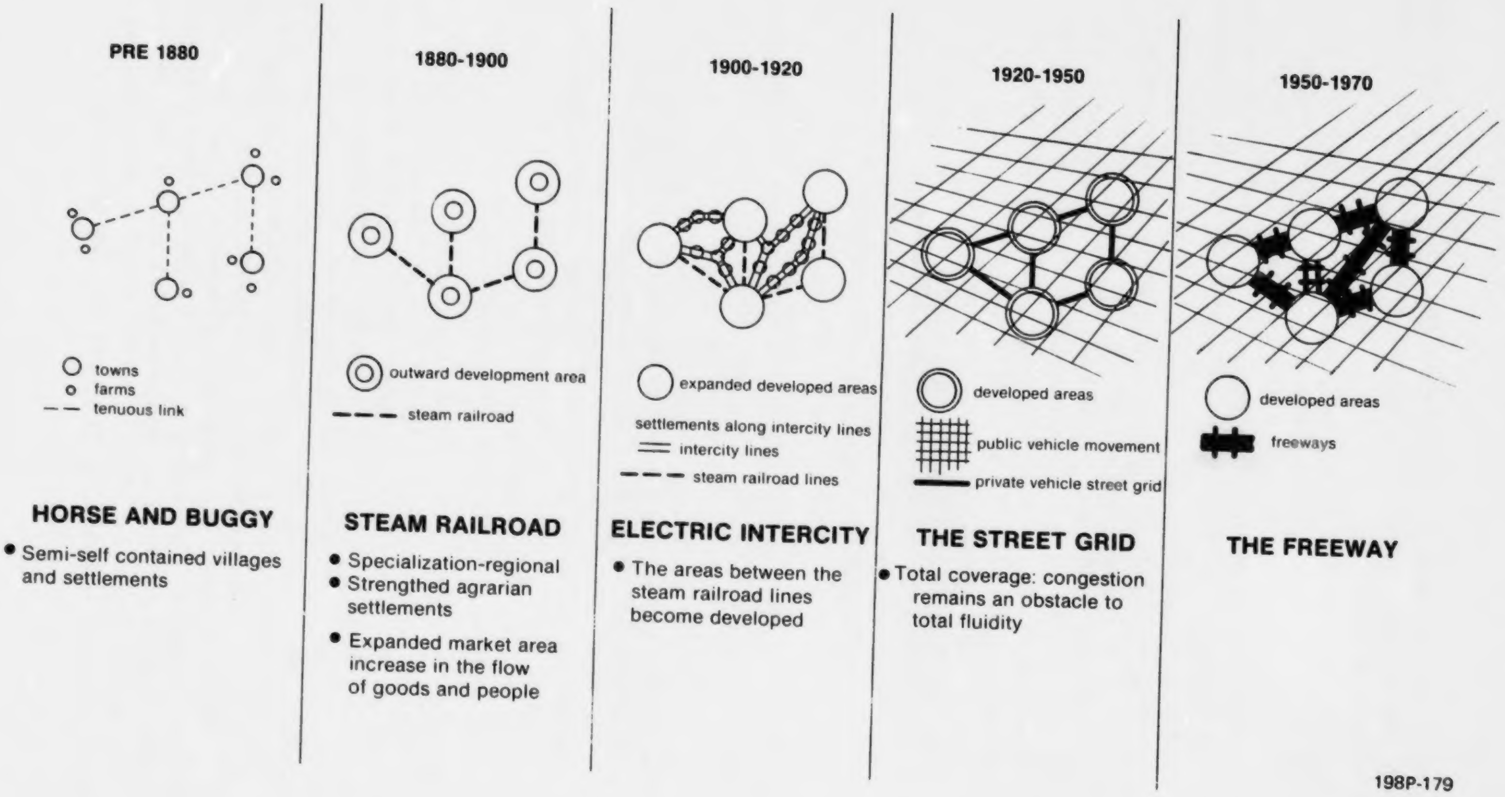
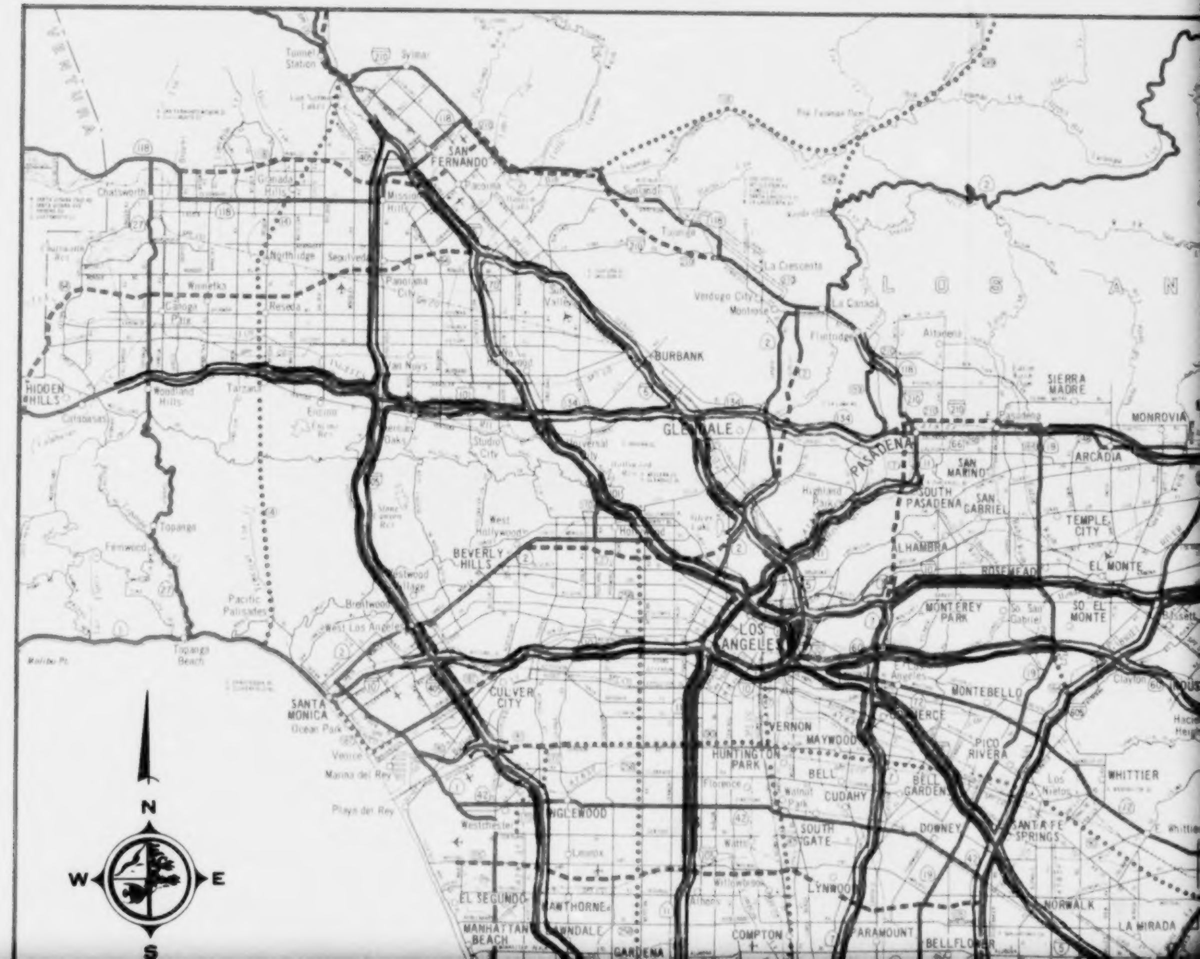

PRE 1880
towns
farms
tenuous link
HORSE AND BUGGY
Semi-self contained villages and settlements
1880-1900
outward development area
steam railroad
STEAM RAILROAD
Specialization-regional
Strengthed agrarian settlements
Expanded market area increase in the flow of goods and people
1900-1920
expanded developed areas
settlements along intercity lines
intercity lines
steam railroad lines
ELECTRIC INTERCITY
The areas between the steam railroad lines become developed
1920-1950
developed areas
public vehicle movement
private vehicle street grid
THE STREET GRID
Total coverage: congestion remains an obstacle to total fluidity
1950-1970
developed areas
freeways
THE FREEWAY
198P-179

Figure II-111. History of transportation improvements during the past ninety years.

- A


VENTURA
Tunnel Station
Sylmar
SAN FERNANDO
Chatsworth
Granada Hills
Mission Hills
Pacoima
Sunland
Tujunga
La Crescenta
Northridge
Sepulveda
Winnetka
Canoga Park
Reseda
Panorama City
Sun Valley
Verdugo City
Montrose
La Canada
Altadena
Flintridge
L O S A N
BURBANK
SIERRA MADRE
MONROVIA
HIDDEN HILLS
Woodland Hills
Tarzana
Encino
Calabasas
Van Nuys
Sherman Oaks
Studio City
GLENDALE
PASADENA
ARCADIA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
Highland Park
Topanga
Fernwood
West Hollywood
BEVERLY HILLS
Hollywood
ALHAMBRA
ROSEMEAD
EL MONTE
Westwood Village
Brentwood
Pacific Palisades
West Los Angeles
MONTEREY PARK
So. San Gabriel
SO. EL MONTE
LOS ANGELES
Malibu Pt.
Topanga Beach
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
CULVER CITY
MONTEBELLO
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
BELL GARDENS
PICO RIVERA
Los Nietos
WHITTIER
Florence
Walnut Park
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
INGLEWOOD
Westchester
Watts
Lennox
LYNWOOD
EL SEGUNDO
HAWTHORNE
NORWALK
LA MIRADA
MANHATTAN BEACH
LAWNDALE
COMPTON
PARAMOUNT
BELLFLOWER
GARDENA
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B

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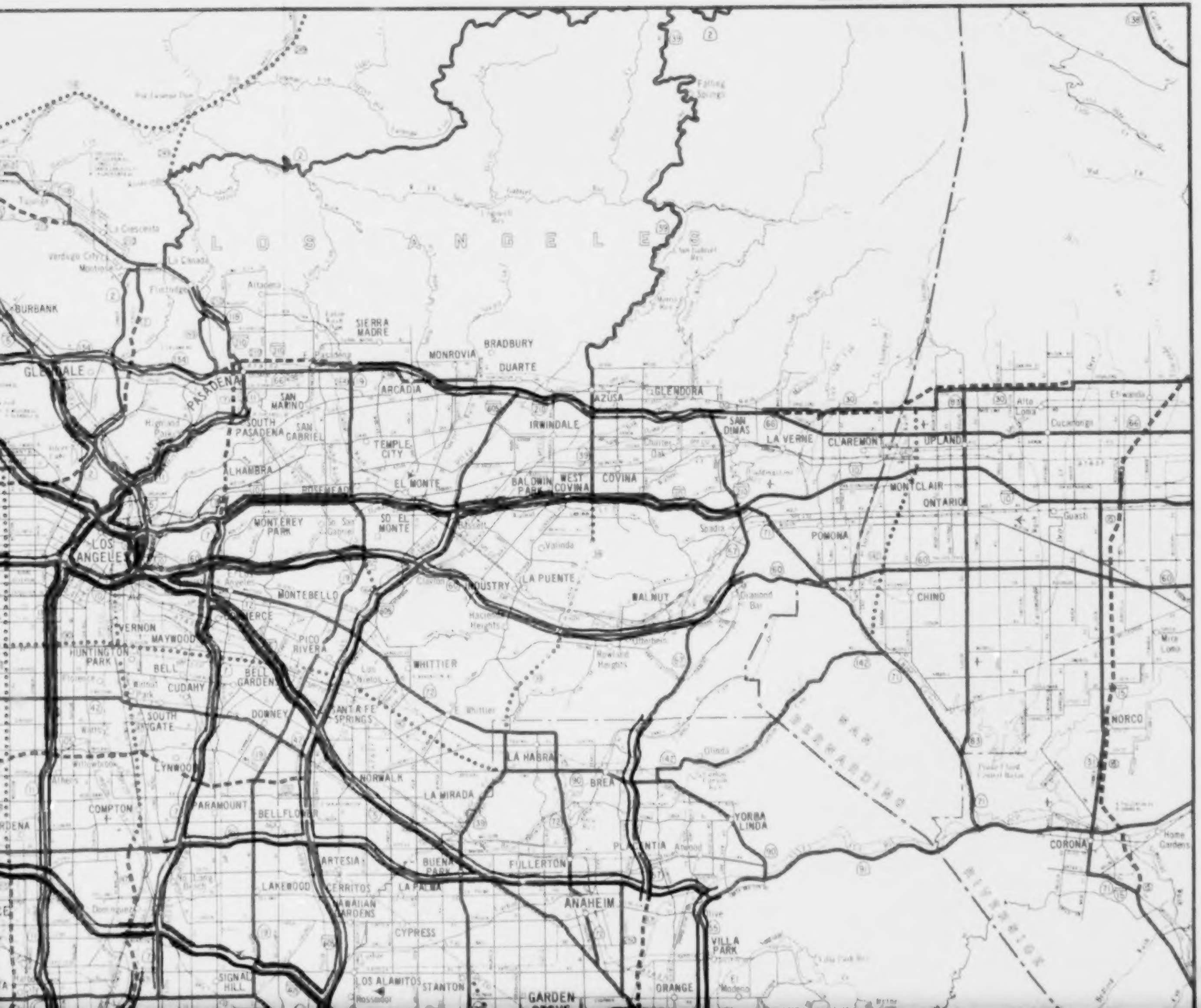
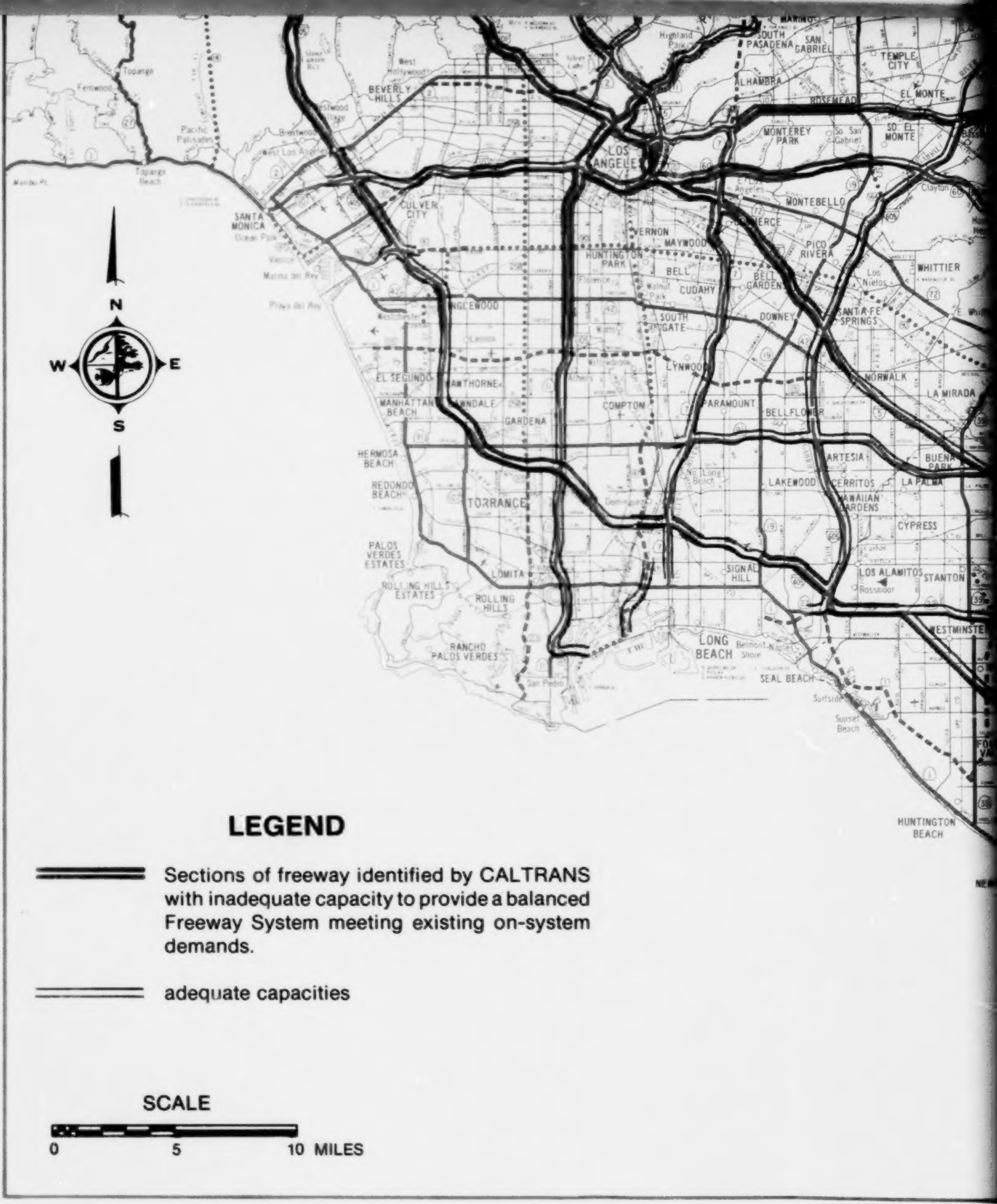

L O S A N G E L E S
BURBANK
GLENDALE
La Crescenta
Verdugo City
Montrose
La Canada
Altadena
PASADENA
SIERRA MADRE
MONROVIA
BRADBURY
DUARTE
ARCADIA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
ALHAMBRA
TEMPLE CITY
ROSEMEAD
EL MONTE
IRWINDALE
AZUSA
GLENDORA
BALDWIN PARK
WEST COVINA
COVINA
SAN DIMAS
LA VERNE
CLAREMONT
UPLAND
Alta Loma
Cucamonga
Etiwanda
MONTCLAIR
ONTARIO
Guasti
POMONA
MONTEREY PARK
SO. EL MONTE
LOS ANGELES
INDUSTRY
LA PUENTE
WALNUT
Diamond Bar
CHINO
MONTEBELLO
COMMERCE
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
PICO RIVERA
BELL GARDENS
WHITTIER
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
LYNWOOD
COMPTON
PARAMOUNT
BELLFLOWER
NORWALK
LA MIRADA
LA HABRA
BREA
YORBA LINDA
PLACENTIA
FULLERTON
ARTESIA
BUENA PARK
LA PALMA
LAKEWOOD
CERRITOS
HAWAIIAN GARDENS
CYPRESS
ANAHEIM
VILLA PARK
ORANGE
LOS ALAMITOS
STANTON
GARDEN GROVE
SIGNAL HILL
SAN BERNARDINO
RIVERSIDE
NORCO
CORONA
Home Gardens
Mira Loma
Falling Springs


N
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S
LEGEND
Sections of freeway identified by CALTRANS with inadequate capacity to provide a balanced Freeway System meeting existing on-system demands.
adequate capacities
SCALE
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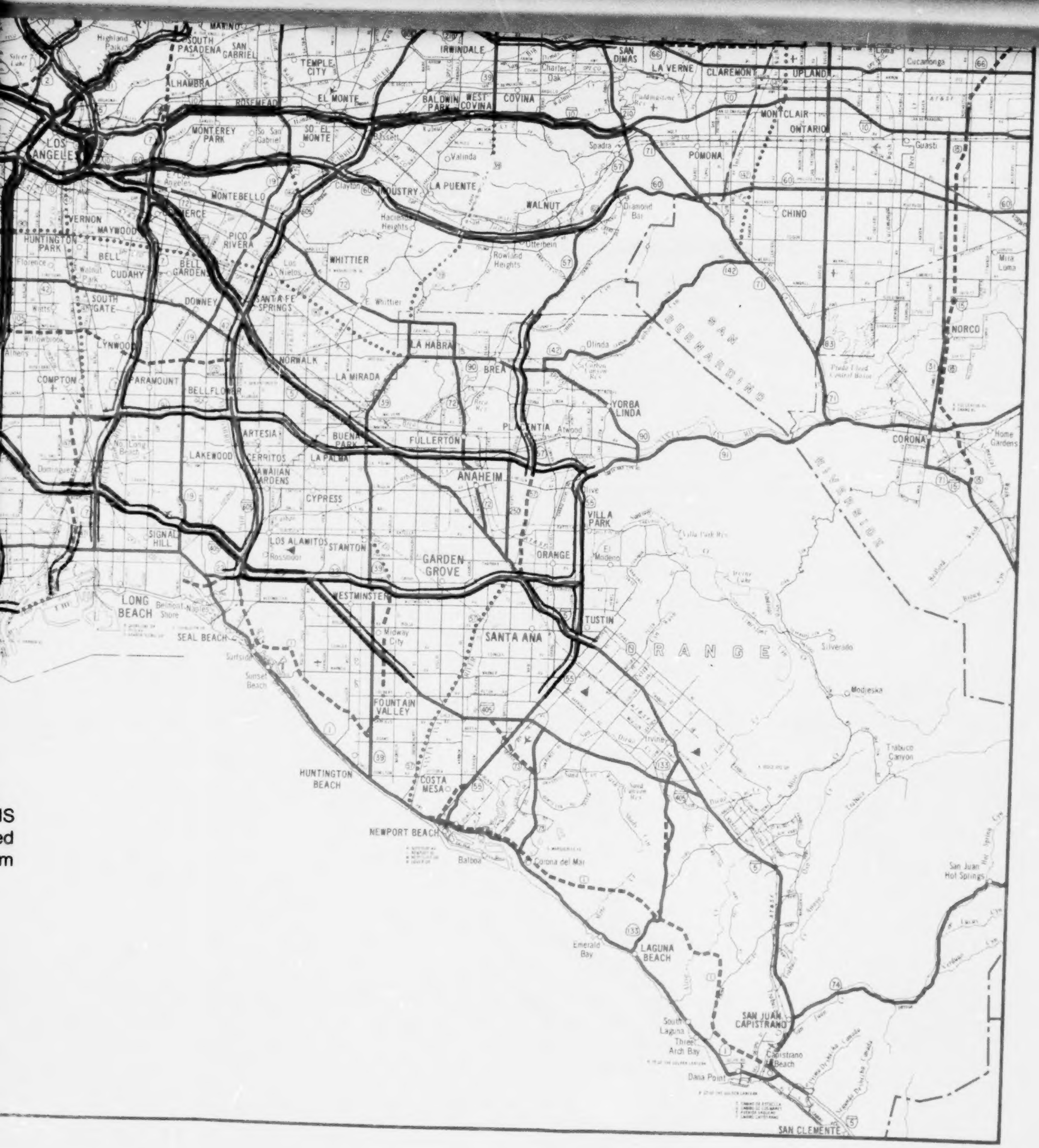
5
10 MILES
Topanga
Fernwood
Pacific Palisades
Brentwood
West Los Angeles
Topanga Beach
Malibu Pt.
West Hollywood
BEVERLY HILLS
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
CULVER CITY
Highland Park
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
EL MONTE
ALHAMBRA
ROSEMEAD
MONTEREY PARK
So. San Gabriel
SO. EL MONTE
LOS ANGELES
MONTEBELLO
COMMERCE
PICO RIVERA
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY
Walnut Park
Florence
SOUTH GATE
Los Nietos
WHITTIER
DOWNEY
SANTA FE SPRINGS
INGLEWOOD
Westchester
Lennox
LYNWOOD
NORWALK
LA MIRADA
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
GARDENA
COMPTON
PARAMOUNT
BELLFLOWER
ARTESIA
BUENA PARK
HERMOSA BEACH
REDONDO BEACH
TORRANCE
LAKEWOOD
CERRITOS
LA PALMA
HAWAIIAN GARDENS
CYPRESS
Dominguez
PALOS VERDES ESTATES
LOMITA
SIGNAL HILL
LOS ALAMITOS
Rossmoor
STANTON
ROLLING HILLS ESTATES
ROLLING HILLS
RANCHO PALOS VERDES
San Pedro
LONG BEACH
Belmont Shore
Naples
SEAL BEACH
Surfside
Sunset Beach
WESTMINSTER
HUNTINGTON BEACH

Figure II-112. Primary surface streets and completed freeways in Los Angeles.


MARINO
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SAN GABRIEL
Highland Park
ALHAMBRA
TEMPLE CITY
IRWINDALE
SAN DIMAS
LA VERNE
CLAREMONT
UPLAND
Cucamonga
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
COVINA
Charter Oak
MONTCLAIR
ONTARIO
LOS ANGELES
MONTEREY PARK
So. San Gabriel
SO. EL MONTE
Bassett
Valinda
Spadra
POMONA
Guasti
MONTEBELLO
INDUSTRY
LA PUENTE
WALNUT
Diamond Bar
CHINO
VERNON
MAYWOOD
COMMERCE
PICO RIVERA
HUNTINGTON PARK
BELL
Florence
Walnut Park
CUDAHY
BELL GARDENS
Los Nietos
WHITTIER
Hacienda Heights
Rowland Heights
Otterbein
Mira Loma
SOUTH GATE
Watts
DOWNEY
SANTA FE SPRINGS
Whittier
LYNWOOD
Willowbrook
Athens
NORWALK
LA HABRA
BREA
Olinda
SAN BERNARDINO
NORCO
COMPTON
PARAMOUNT
BELLFLOWER
LA MIRADA
YORBA LINDA
Prado Flood Control Basin
ARTESIA
BUENA PARK
FULLERTON
PLACENTIA
Atwood
CORONA
Home Gardens
LAKEWOOD
CERRITOS
LA PALMA
HAWAIIAN GARDENS
ANAHEIM
Dominguez
CYPRESS
VILLA PARK
Villa Park Res
SIGNAL HILL
LOS ALAMITOS
Rossmoor
STANTON
GARDEN GROVE
ORANGE
El Modena
Irvine Lake
LONG BEACH
Belmont Shore
Naples
SEAL BEACH
WESTMINSTER
TUSTIN
Midway City
SANTA ANA
ORANGE
Silverado
Surfside
Sunset Beach
FOUNTAIN VALLEY
Modjeska
Irvine
Trabuco Canyon
HUNTINGTON BEACH
COSTA MESA
NEWPORT BEACH
Balboa
Corona del Mar
San Juan Hot Springs
Emerald Bay
LAGUNA BEACH
SAN JUAN CAPISTRANO
South Laguna
Three Arch Bay
Capistrano Beach
Dana Point
SAN CLEMENTE
RIVERSIDE

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D

Table II-57. Status of state highway construction in Los Angeles, Orange, and Ventura Counties, 1975.

	LOS ANGELES CITY	LOS ANGELES COUNTY	ORANGE COUNTY	VENTURA COUNTY	TOTAL
Constructed Freeway	148.4	473.4	129.7	82.3	685.4
Constructed Expressway	2.4	11.2	8.7	7.9	27.8
Constructed Highway (Conventional)	64.0	419.6	116.8	175.1	711.5
Freeway Under Construction	7.2	14.9	2.9	3.9	21.7
Expressway Being Converted*	0.0	3.1	0.0	0.2	3.3
Freeway Open to Traffic	148.4	476.3	129.7	82.3	688.3

*"Converted" includes replaced by freeway on new location.

The Southern California Rapid Transit District (SCRTD) owns and operates the public bus system serving most of the Los Angeles area. Figure II-113 presents the SCRTD system in 1975. The SCRTD operates the fourth largest transit system in the nation with 95 percent of its patronage in Los Angeles County. The SCRTD fleet consists of over 2400 buses and provides service for 700,000 daily fares. The buses travel more than 347,000 miles per day in covering a four-county area. Pending construction of a rapid transit system, the bus system constitutes the major mode of public transportation. With a rapid transit system, buses would provide "feeder" service to transit stations and would continue to provide flexible local and long-distance public transportation service to areas not accommodated by rapid or other public (park-and-ride, dial-a-ride, etc.) transit.

Public bus service will be most important for those citizens who rely upon it for movement in an area, as well as for persons who wish an alternative to the automobile. The roadway network is utilized for public as well as private transportation. In greater Los Angeles area (SCAG region), there are 22 transit agencies providing public service to more than 200 million passengers (SCAG-75). The transit agencies serving the region, the fleetsize, and the usage are shown in Table II-58. Collectively, these agencies operate over 1,300 buses (SCAG-75).

Several taxi cab companies offer service in the Los Angeles area. Cab service is primarily oriented to providing service to connect major transportation centers, such as airports, tram depots, and bus terminals to business and hotel centers. Cab service has a small role in home-to-work or home-to-shopping trips.

(a) Circulation Characteristics. The California Freeway and Expressway System (Figure II-113 and the Highways and Freeways Element of the Los Angeles Citywide General Plan are the two major freeway system plans for the Los Angeles County. The existing routes are primarily

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Table II-58. Transit Company data (SCAG-75).

	NUMBER OF BUSES		ANNUAL BUS MILES		ANNUAL NUMBER OF PASSENGERS	
	FY73-74	FY74-75 (ESTIMATES)	FY73-74	FY74-75 (ESTIMATES)	FY73-74	FY74-75 (ESTIMATES)
Southern California Rapid Transit District	1,171	2,109	66,165,900	75,016,300	188,931,000	195,000,000
Santa Monica Municipal Bus Lines	104	104	3,206,500	3,248,000	10,296,000	10,500,000
City of Gardena Municipal Bus Lines	28	30	802,700	885,900	1,289,300	1,260,000
City of Montebello Transit Utility Company	25	27	941,200	985,700	1,172,104	2,250,000
South Coast Area Transit	23	23	704,250	896,750	1,126,000	1,510,000
Torrance Transit System	18	18	587,210	593,200	531,650	520,000
City of Commerce Bus Lines	10	13	158,700	186,000	403,600	417,500

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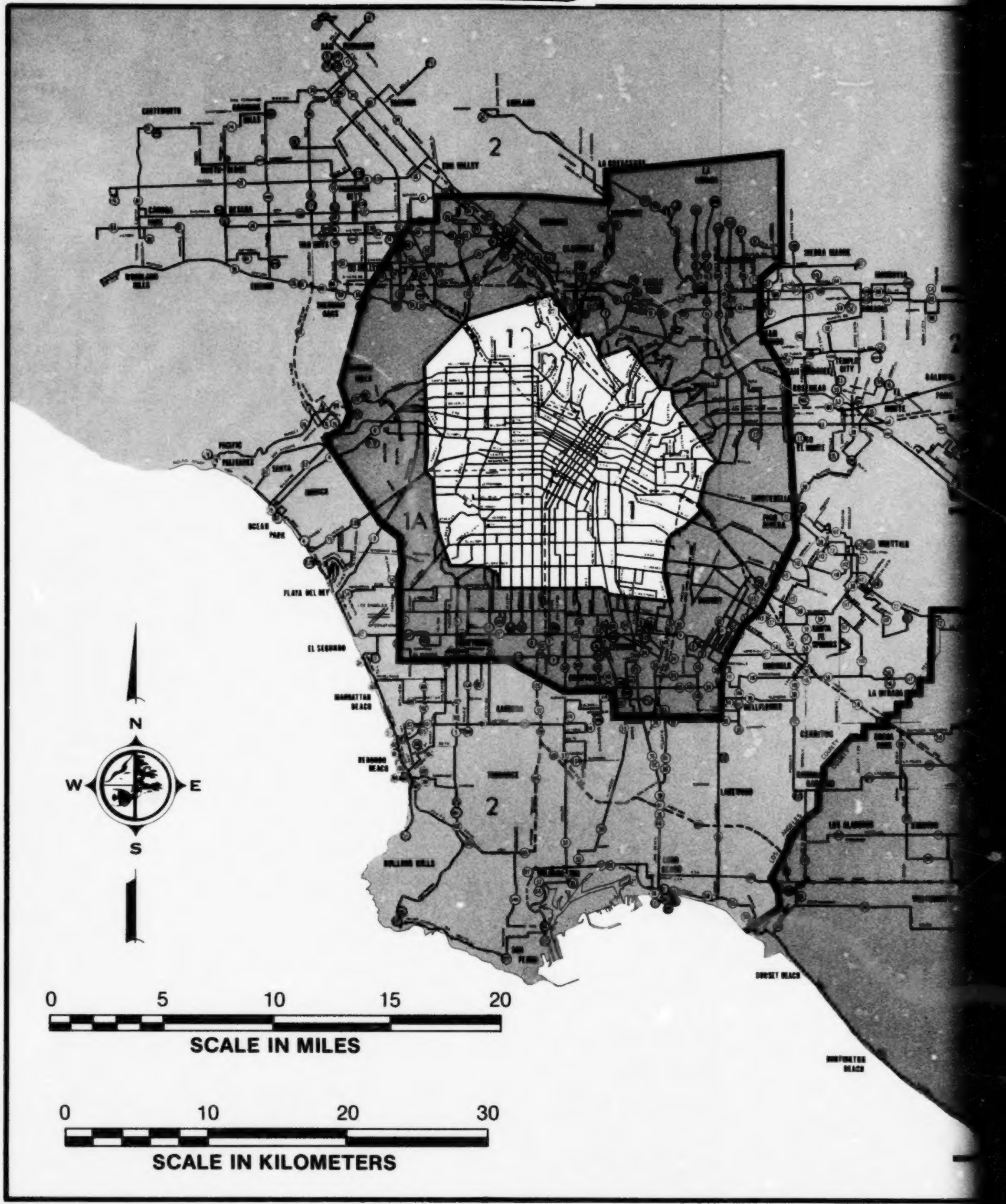
2
1
1
1A
2
2
PACIFIC PALISADES
OCEAN PARK
PLAYA DEL REY
EL SEGUNDO
MANHATTAN BEACH
REDONDO BEACH
ROLLING HILLS
SAN PEDRO
LONG BEACH
LAKEWOOD
WHITTIER
LA MIRADA
SUNSET BEACH
HUNTINGTON BEACH
N
W
E
S
0
5
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20
SCALE IN MILES
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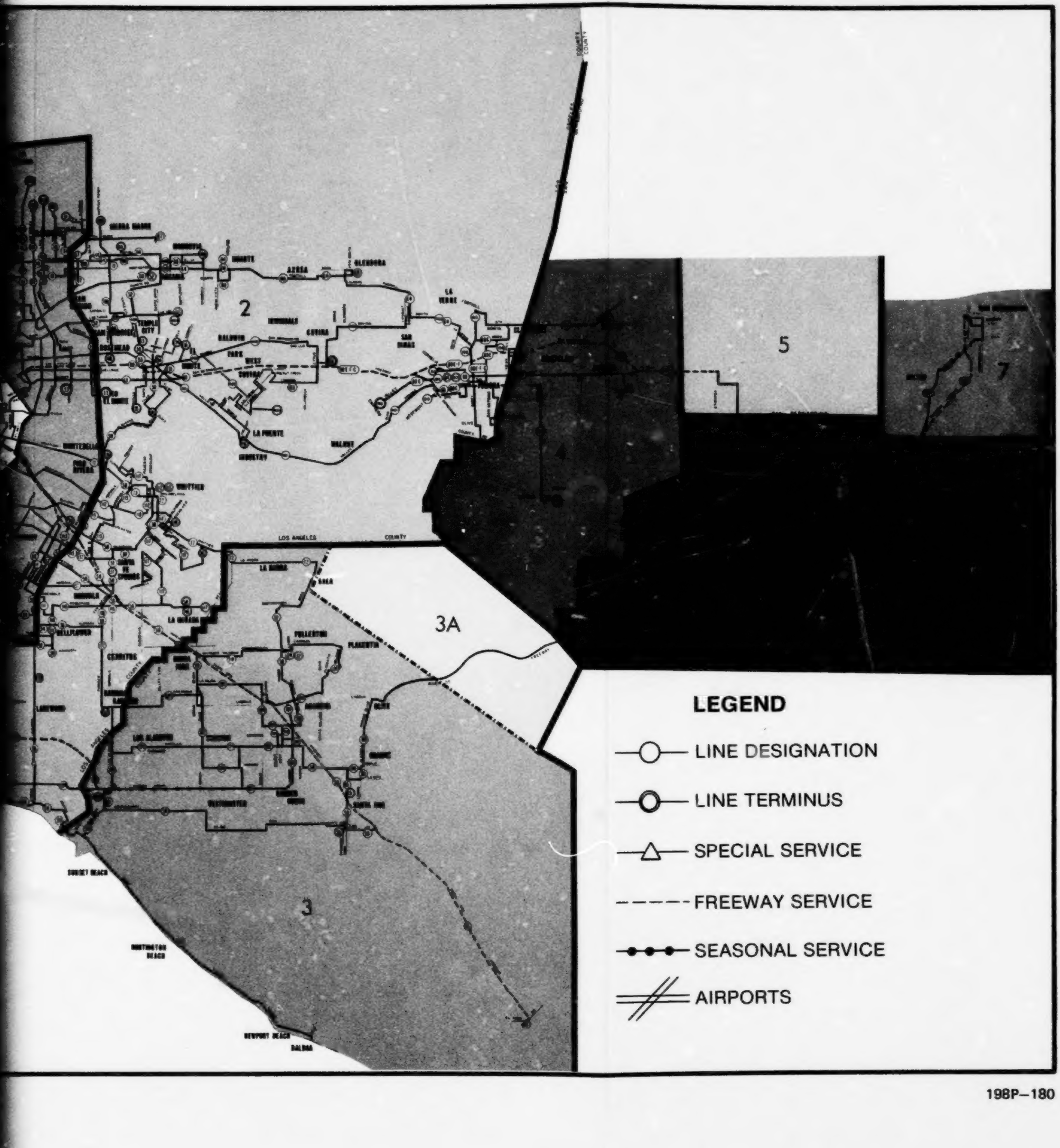
10
20
30
SCALE IN KILOMETERS

Figure II-113. The Southern California Rapid Transit District System for 1975.


2
3
3A
4
5
7
SIERRA MADRE
MONROVIA
DUARTE
AZUSA
GLENDORA
LA VERNE
SAN DIMAS
COVINA
BALDWIN PARK
WEST COVINA
TEMPLE CITY
EL MONTE
LA PUENTE
INDUSTRY
WALNUT
POMONA
MONTEBELLO
WHITTIER
LOS ANGELES COUNTY
LA HABRA
BREA
FULLERTON
PLACENTIA
LA MIRADA
NORWALK
BELLFLOWER
CERRITOS
LAKEWOOD
LOS ALAMITOS
WESTMINSTER
GARDEN GROVE
SANTA ANA
ORANGE
ANAHEIM
SUNSET BEACH
HUNTINGTON BEACH
NEWPORT BEACH
BALBOA
LEGEND
LINE DESIGNATION
LINE TERMINUS
SPECIAL SERVICE
FREEWAY SERVICE
SEASONAL SERVICE
AIRPORTS

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radial, with focus upon downtown. Recently, however, nonradial "loops" have been built to serve other major areas and to relieve congestion on existing radial routes.

Following are the major observations and conclusions drawn from evaluations of transportation system by the Southern California Association of Governments, the City and County of Los Angeles, and the California Department of Transportation. Barring a revolution in ground transportation systems or a major shift in housing and/or employment patterns, these trends can be expected to continue.

In 1967 the Los Angeles Regional Transportation Study (LARTS) conducted an origin and destination survey in the region. On the average 3.2 person trips per day were generated per person and had the following characteristics.

TRIPS BY TRIP TYPE. The trips by trip type for Los Angeles County are given in Figure II-114. The home-other trip type is predominant in all modes except public bus, and includes trips made for leisure activities, education, and family business. In the public bus passenger mode, 90.2 trips were work related, with a trip end at the place of work; approximately 48 percent of the total bus trips were made by riders that did not have a vehicle available at their place of residence. In the auto driver mode, the home-work trip type ranks second in volume. This single trip type accounts for 27.2 percent of the total auto driver trips. It is well known that these trips occur, for the most part, during morning and afternoon peak periods, due to commuter travel. The "other" trip category includes social or entertainment, recreation, and family business trips (LARTS, 1971).

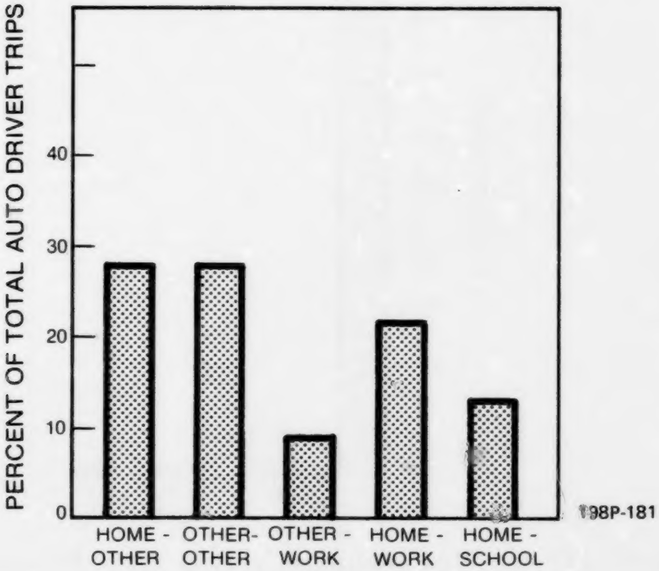

Figure II-114. Percentage of auto driver trips by trip type.

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The predominance of the auto as a mode of travel within the study area is shown in Figure II-115 for selected modes with volumes greater than fifty thousand.

VEHICLE OCCUPANCY. The average number of occupants in a car varies according to the purpose of the trip. Figure II-116 shows the auto occupancy rates, on an average weekday, for each of the five basic trip types. The work related trips have the lowest occupancy rates, indicating the lack of car pooling practices among commuters within the study area. Low vehicle occupancy rates for work trips are further accented by selecting vehicle drivers that used the freeway to work and recording the number of passengers in the vehicle upon arrival at the work site. As shown in Figure II-116, nearly 94 percent of those vehicle drivers did not carry any passengers enroute to work. The average occupancy rate by freeway commuters is a low 1.1 persons per vehicle - approximately twelve persons for every eleven vehicles used for this purpose (LARTS, 1971).

Figure II-117 shows estimated trip type versus trip length. The figure was prepared based on the assumption that trips are normally distributed about the mean trip length. For shorter trips, the home-other and home-shopping dominate, while the work trips dominate the longer trips. This suggests that mini-buses or bicycles could be effective trip reduction measures for short trips. Home-buses trips and express buses or carpools could be effective for reducing commute trips by increasing occupancy rates.

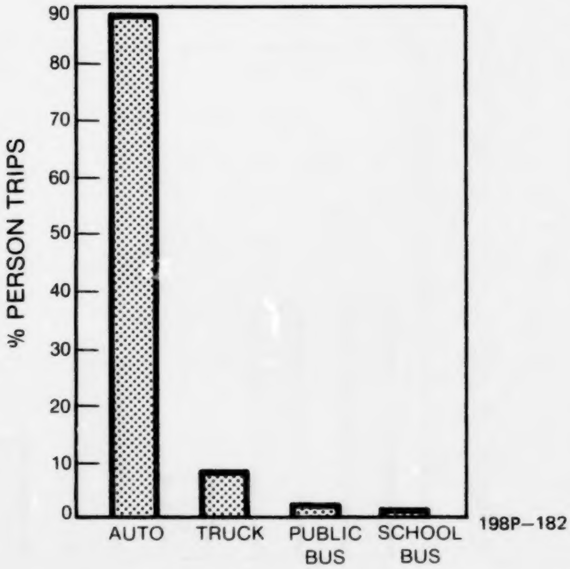


Figure II-115. Percentage of person trips by mode of travel.

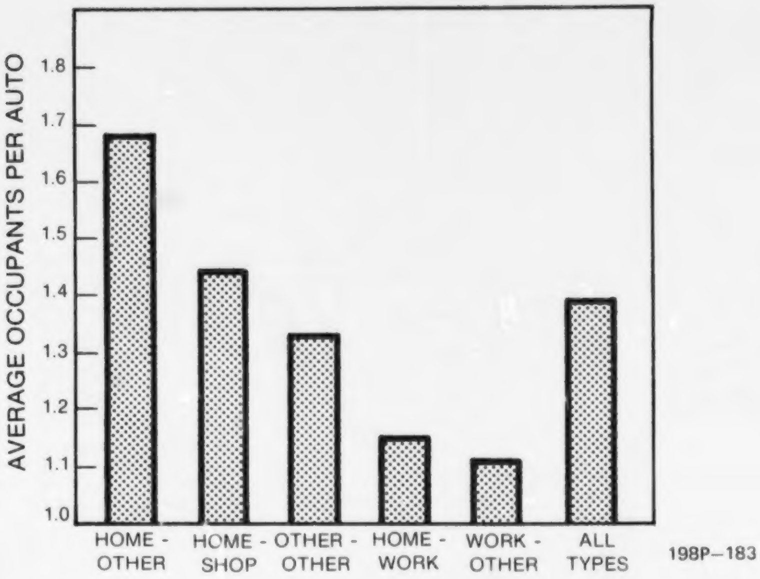
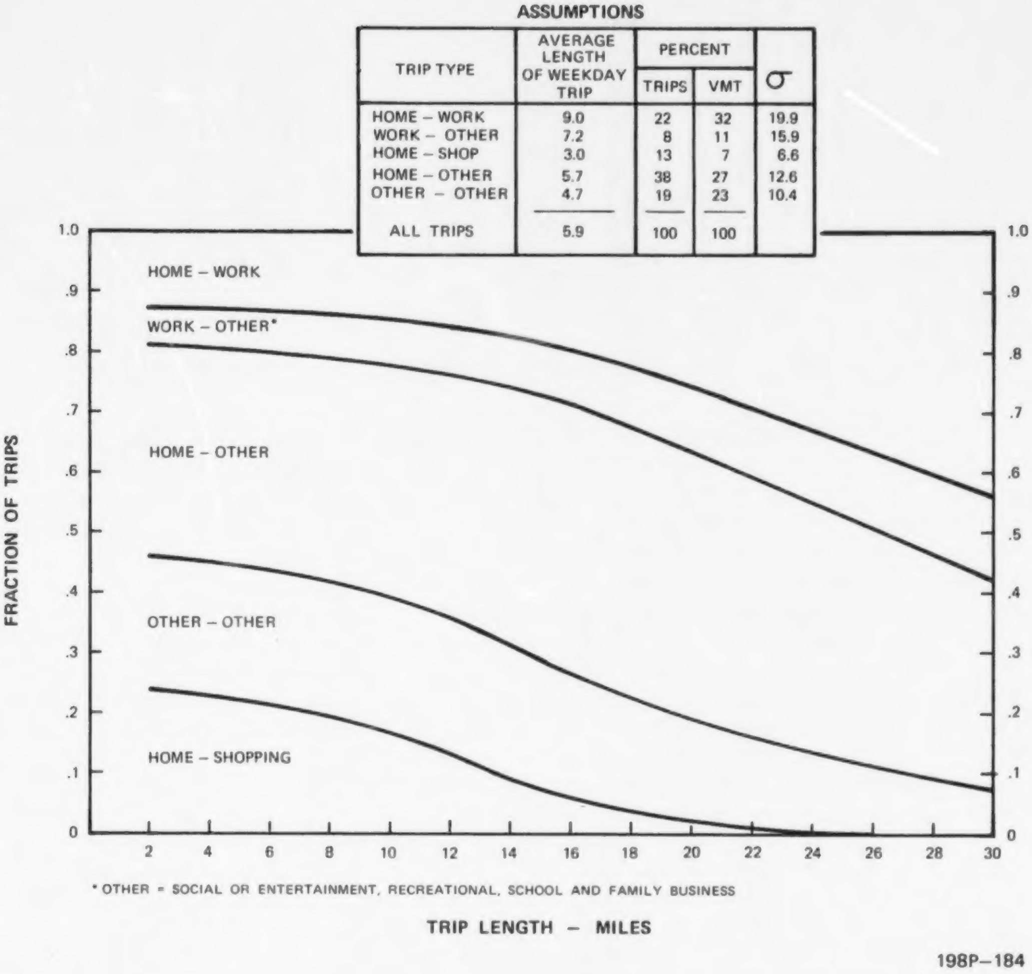


Figure II-116. Average number of occupants per auto by trip type.

Travel characteristics in the San Fernando Valley are virtually identical to those of the Los Angeles Region as a whole. Figure II-118 is the result of a Los Angeles City Traffic Department computer model run for the peak-hour trips (heavily weighted with home-to-work trips). The figure shows that trips in the San Fernando Valley are very similar to trips in the rest of the basin, in terms of average trip length and trip time. Also, a high percentage of trips are relatively short (6 miles or less); this agrees with the LARTS findings of 1967. Table II-59 and II-60 show that although a high proportion of the trips in Los Angeles average about six miles in length or less, the longer trips (up to 20 miles) represent a high proportion of the VMT and fuel consumption. Table II-61 summarizes energy demands for several modes of transportation. The data indicates that public transportation systems are presently about 2 to 4 times as energy efficient as a standard sized automobile on a seat-mile basis. Recent studies by the Rand Corporation, General Research Corporation, and the University of California at Los Angeles indicate that if a trend for smaller, lighter more energy efficient vehicles develops, the average fleet fuel consumption rates could be cut in half by 1990. Thus, in the future, small gasoline autos could theoretically approach the energy efficiency levels of today's public transportation systems.

Estimates of daily trips between selected portions of the Service Area were computed using the Cities' traffic simulation model (for a discussion of the model see Appendix II-A). The selected portions are the traffic analysis zones shown in Figure II-119. These zones are aggregates of census tracts and were selected to approximate ten kilometer grid



ASSUMPTIONS

TRIP TYPE	AVERAGE LENGTH OF WEEKDAY TRIP	PERCENT		σ
		TRIPS	VMT	
HOME – WORK	9.0	22	32	19.9
WORK – OTHER	7.2	8	11	15.9
HOME – SHOP	3.0	13	7	6.6
HOME – OTHER	5.7	38	27	12.6
OTHER – OTHER	4.7	19	23	10.4
ALL TRIPS	5.9	100	100	

* OTHER = SOCIAL OR ENTERTAINMENT, RECREATIONAL, SCHOOL AND FAMILY BUSINESS

Figure II-117. Proportion of total trips according to trip type and trip length.

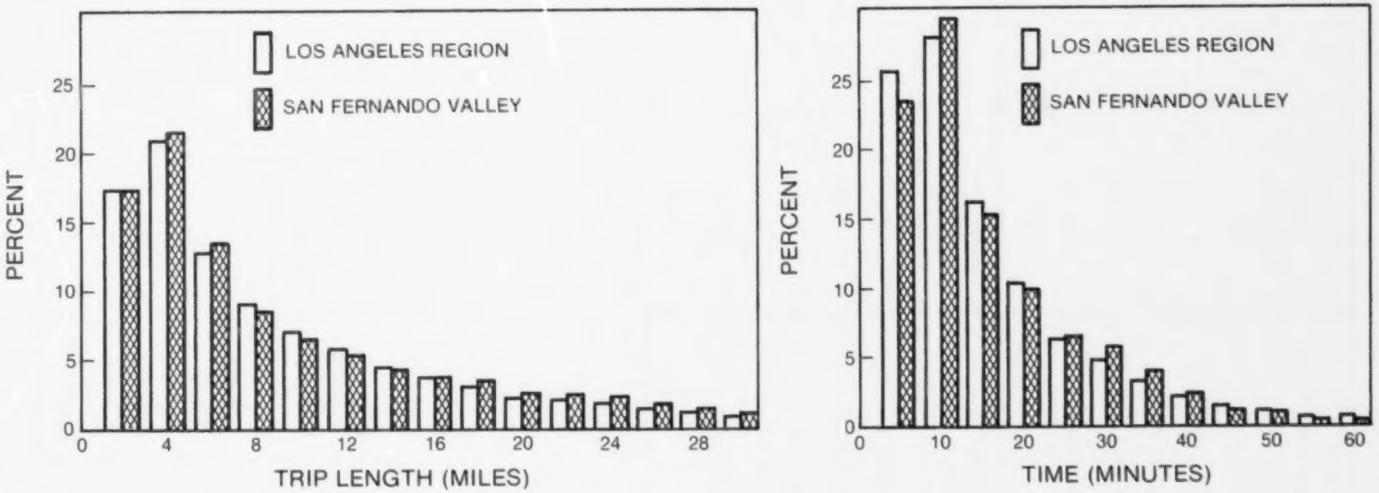


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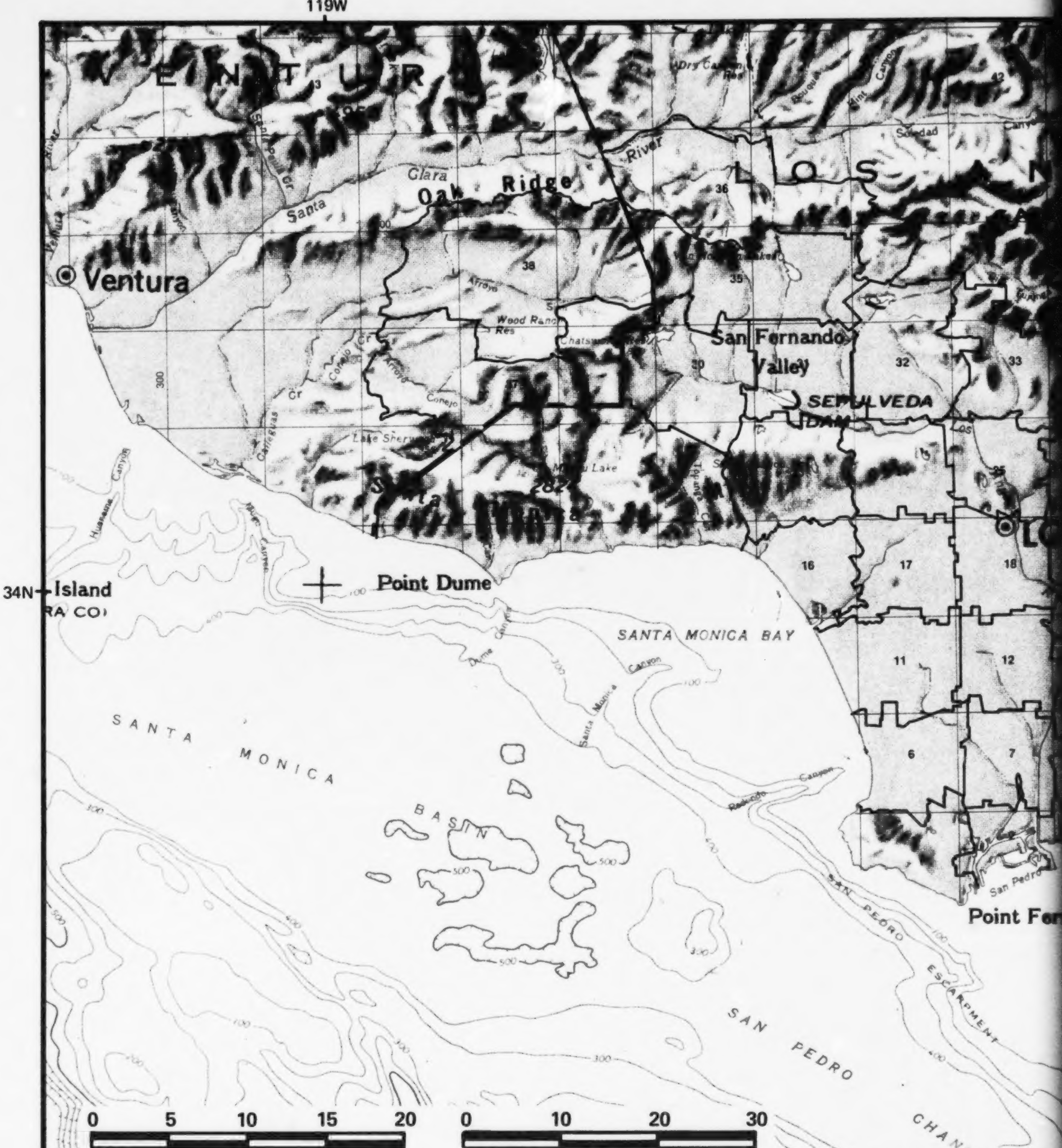
Figure II-118. Los Angeles City Traffic Department computer model run for peak-hour trips.

Table II-59. Trip type distributions (City of Los Angeles, 1975).

TRIP TYPE (ORIGIN - DESTINATION)	1970/74 (%) TRIPS	TRIP LENGTH (TYPE/MILES)
Home-work	21.3%	7.6
Home-school	13.3	5.3
Home-other	27.9	6.0
Other-work	9.3	4.8
Other-other	28.2	6.4
Total	100.0%	
TRIP TYPE (ORIGIN - DESTINATION)	**1990 (%) TRIPS**	**TRIP LENGTH (TYPE/MILES)**
Home-work	21.3%	8.4
Home-school	13.4	6.2
Home-other	28.1	6.8
Other-work	9.1	5.1
Other-other	28.1	7.0
Total	100.0%	

Table II-60. Trip scale (SCAG-75).

TRIP SCALE	TRIP LENGTH (MILES)	PERCENT TOTAL PERSON TRIPS	PERCENT TOTAL VMT	PERCENT FUEL CONSUMPTION
Activity Center	0-2	25	4	14.3
Community	1-6	41	17	18
Metropolitan	4-20	27	43	36
Intermetropolitan	15-60	6	27	24.2
Regional	Over 40	1	9	7.4


119W
V E N T U R A
Santa Clara River
Oak Ridge
L O S A N
Ventura
Wood Ranch Res
Chatsworth
San Fernando Valley
SEPULVEDA DAM
Lake Sherwood
Malibu Lake
Point Dume
34N
Island
SANTA MONICA BAY
SANTA MONICA BASIN
SAN PEDRO CHANNEL
SAN PEDRO ESCARPMENT
Redondo Canyon
Santa Monica Canyon
Dume Canyon
San Pedro
Point Fer
36
38
35
30
32
33
16
17
18
11
12
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SCALE IN MILES
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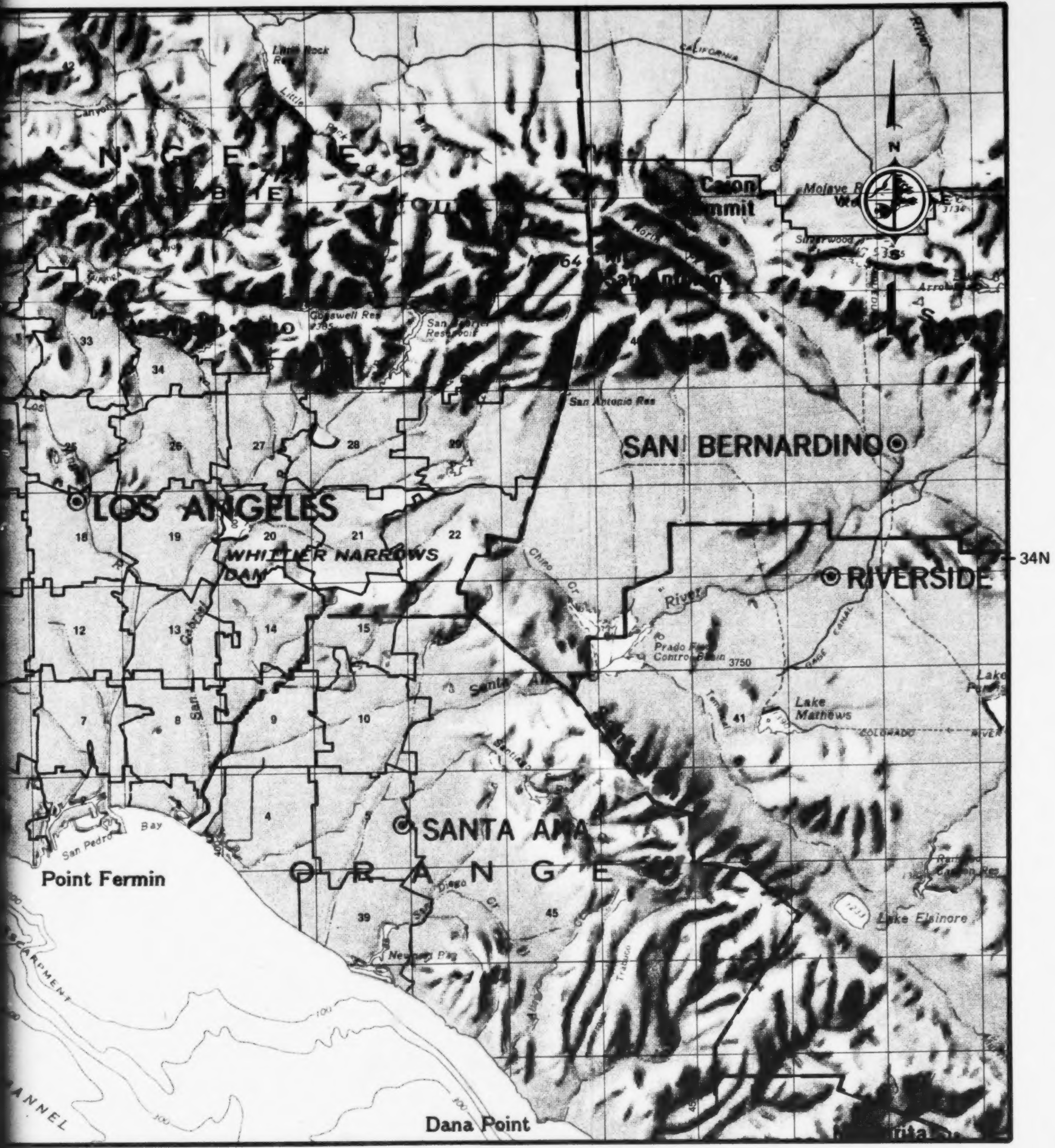
30
SCALE IN KILOMETERS
119W

Figure II-119. Air quality model traffic analysis zones.



SAN BERNARDINO
RIVERSIDE
LOS ANGELES
SANTA ANA
O R A N G E
WHITTIER NARROWS DAM
Point Fermin
Dana Point
San Pedro Bay
Newport Bay
Cajon Summit
Mojave River
San Antonio Res
Cogswell Res
San Gabriel Reservoir
Little Rock Res
Prado Flood Control Basin
Lake Mathews
Lake Elsinore
Santa Ana River
Chino Cr
San Gabriel
Santiago
San Diego Cr
Trabuco
COLORADO RIVER
CALIFORNIA
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64

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Table II-61. Comparison of estimated energy demand for various vehicles (Healy, 1974).

VEHICLE	WEIGHT	SEATS	BTU/VM^2	BTU/SM^3	BTU/PM^1
Gas Auto (Small	2,000 lbs.	4	4,750	1,187	4,748
Gas Auto (Large)	4,000	5	9,500	1,900	7.600
Electric Auto (Small)	2,000	4	4,960	1,172	4,688
Electric Auto (Large)	4,000	5	9,360	1,872	7,488
PRT (Personal)	2,000	4	3,000	750	3,000
PRT (Group)	6,000	10	9,350	935	3,740
Commuter Rail	180,000	150	154,500	1,030	4,120
Rail Rapid Transit	58,000	72	58,500	812	3,248
Trolley (LRV)	40,000	63	64,300	1,020	4,080
Fixed Route Bus	20,000	50	37,750	755	3,020
Express Bus	20,000	50	29,600	592	2,368
Demand Responsive Bus	N.A.	19	N.A.	1,703	6,812
Jitney	8,000	8	17,040	2,130	8,520

[1] Assumes a 25 percent load factor (Btu's per passenger mile).
[2] British Thermal Units per Vehicle Mile.
[3] BTU's per Seat Mile.

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cells, a common grid system used in air quality modeling. Two conclusions can be drawn from the triangular trip table (Table II-62) for 1974:

- A high proportion of trips are within the zones (due in part to the large size of the zones), (intrazonal), and
- The farther apart the zones are, the fewer the trips between the zones (interzonal).

Transportation effects on air quality are functionally related to vehicle miles traveled (VMT) as well as trips. Airline distances between zones (times a correction factor to represent a "truer" trip length) were incorporated and VMTs were computed for the same table. Table II-63 shows that although there are few trips between distant zones, the long distance traveled can compensate to produce significant VMTs within the City.

As the street and freeway system developed in Los Angeles, off-peak hour travel times to the Central Business District decreased. Figure II-120 shows 30-minute isochrones for downtown Los Angeles for the period 1937 to 1971. The 1966 contour includes most of Southern Los Angeles County including a large fraction of the San Fernando Valley. The 1971 isochrone is essentially identical to the 1966 one, and was not graphed. Since the freeway system to suburban areas of the Valley, Orange County, and Eastern Los Angeles County was well developed by 1966, and little change occurred between 1966 and 1971, little change is expected in the 1976 30-minute isochrone. Figure II-121 shows the 20-minute isochrone for bus transit in 1971 over surface streets.

In summary, nonwork trips constitute about 70 percent of all vehicle trips within the City. Nonwork trips include the following categories: shopping, school, entertainment, and recreation. Average trip lengths are 6.8 miles in the Hyperion Service Area and 5.4 miles in the San Fernando Valley; the average trip length from the San Fernando Valley to the employment centers in the CBD-Wilshire Corridor is 20.5 miles. Within the LARTS region 16 percent of the VMT occurs on freeways during the peak hours and 27 percent of this VMT occurs on freeways during the off-peak hours.

b. Land Use Factors Influencing Vehicular Travel. Regional office employment has developed in eleven identifiable clusters. Primary considerations include: Los Angeles CBD, Century City, and Wilshire Corridor. Figure II-122 presents an oblique aerial view of the Los Angeles CBD; view is southwest with City Hall in the left center of the photograph. Figure II-123 is a photograph of the Century City concentration. View is southeast with Santa Monica Boulevard in the background. Figure II-124 is a west to east photograph of the Wilshire Corridor from its intersection with Santa Monica Boulevard in the foreground to the CBD in the extreme background. Secondary concentrations include: Los Angeles Airport, Hollywood-Sunset, San Fernando Valley, Westwood, Beverly Hills,

Table II-62. Estimated weekday trips within the Hyperion Service Area (hundreds).

TRIPS FROM ZONE TO ZONE			CBD-WILSHIRE CORRIDOR						SAN FERNANDO VALLEY				
		11. HAWTHORNE	16. SANTA MONICA	17. CULVER CITY	18. DOWNTOWN	23. SHERMAN OAKS	24. WEST HOLLYWOOD	25. GLENDALE	30. TARZANA	31. SEPULVEDA	32. BURBANK	33. LA CRESENTA	35. CHATSWORTH SAN FERNANDO
CBD-WILSHIRE CORRIDOR	11. HAWTHORNE	3,243											
	16. SANTA MONICA	581	3,262										
	17. CULVER CITY	984	1,264	2,916									
	18. DOWNTOWN	601	376	1,698	3,260								
	23. SHERMAN OAKS	81	672	228	107	713							
	24. WEST HOLLYWOOD	119	376	1,272	728	367	2,487						
	25. GLENDALE	89	85	316	1,616	49	817	2,053					
SAN FERNANDO VALLEY	30. TARZANA	48	102	71	112	196	113	58	2,808				
	31. SEPULVEDA	64	163	104	171	487	366	119	785	2,264			
	32. BURBANK	39	63	88	253	99	605	370	114	769	2,118		
	33. LA CRESENTA	23	23	47	225	20	114	570	28	69	442	907	
	35. CHATSWORTH SAN FERNANDO	28	58	45	99	63	97	66	369	770	505	70	1,615
Total Within Hyperion Service Area		4,916,200											
Total Within San Fernando Valley		1,363,300											
Total From Valley to CBD-Wilshire Corridor		162,400											

Table II-63. Estimated weekday VMT within the Hyperion Service Area (thousands).

TRIPS FROM ZONE TO ZONE			CBD-WILSHIRE CORRIDOR						SAN FERNANDO VALLEY				
		11. HAWTHORNE	16. SANTA MONICA	17. CULVER CITY	18. DOWNTOWN	23. SHERMAN OAKS	24. WEST HOLLYWOOD	25. GLENDALE	30. TARZANA	31. SEPULVEDA	32. BURBANK	33. LA CRESENTA	35. CHATSWORTH SAN FERNANDO
CBD-WILSHIRE CORRIDOR	11. HAWTHORNE	1,059											
	16. SANTA MONICA	698	1,065										
	17. CULVER CITY	835	1,073	952									
	18. DOWNTOWN	836	646	1,504	1,064								
	23. SHERMAN OAKS	169	686	315	208	233							
	24. WEST HOLLYWOOD	181	408	864	692	365	812						
	25. GLENDALE	168	161	379	960	89	708	670					
SAN FERNANDO VALLEY	30. TARZANA	147	194	172	325	201	223	155	917				
	31. SEPULVEDA	172	276	198	382	333	485	227	667	739			
	32. BURBANK	98	119	151	423	115	615	443	192	653	691		
	33. LA CRESENTA	66	59	100	383	40	173	629	73	119	391	296	
	35. CHATSWORTH SAN FERNANDO	98	146	121	285	95	198	158	444	653	607	124	843
Total Within Hyperion Service Area		33,214,000		Average Trip = 6.8 Miles.									
Total Within San Fernando Valley		7,409,000		Average Trip = 5.4 Miles.									
Total From Valley To CBD-Wilshire Corridor		3,334,000		Average Trip = 20.5 Miles.									

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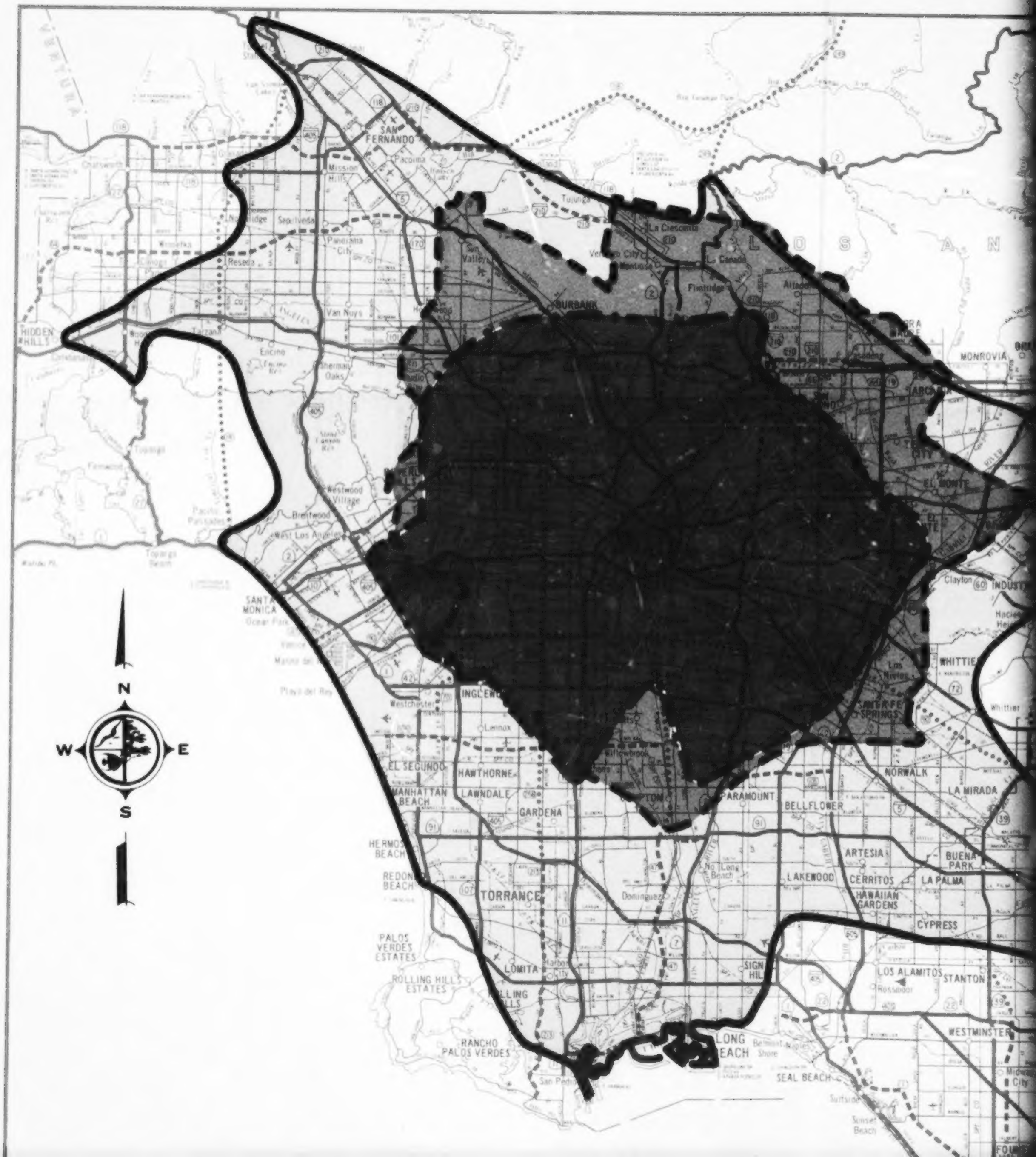
VENTURA
SAN FERNANDO
Mission Hills
Pacoima
Tujunga
Chatsworth
Northridge
Sepulveda
Panorama City
Winnetka
Canoga
Reseda
Van Nuys
Tarzana
Encino
Sherman Oaks
HIDDEN HILLS
Topanga
Pacific Palisades
Topanga Beach
Brentwood
Westwood Village
West Los Angeles
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
Westchester
Lennox
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
GARDENA
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
LOMITA
ROLLING HILLS
RANCHO PALOS VERDES
San Pedro
LONG BEACH
Belmont Shore
SEAL BEACH
Dominguez
LAKEWOOD
CERRITOS
HAWAIIAN GARDENS
ARTESIA
BELLFLOWER
PARAMOUNT
NORWALK
LA MIRADA
BUENA PARK
LA PALMA
CYPRESS
LOS ALAMITOS
Rossmoor
STANTON
WESTMINSTER
Sunset Beach
WHITTIER
Los Nietos
SANTA FE SPRINGS
Clayton
INDUSTRY
EL MONTE
MONROVIA
BURBANK
Sun Valley
Verdugo City
Montrose
La Crescenta
La Canada
Flintridge
Altadena
L O S A N
N
W
E
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B

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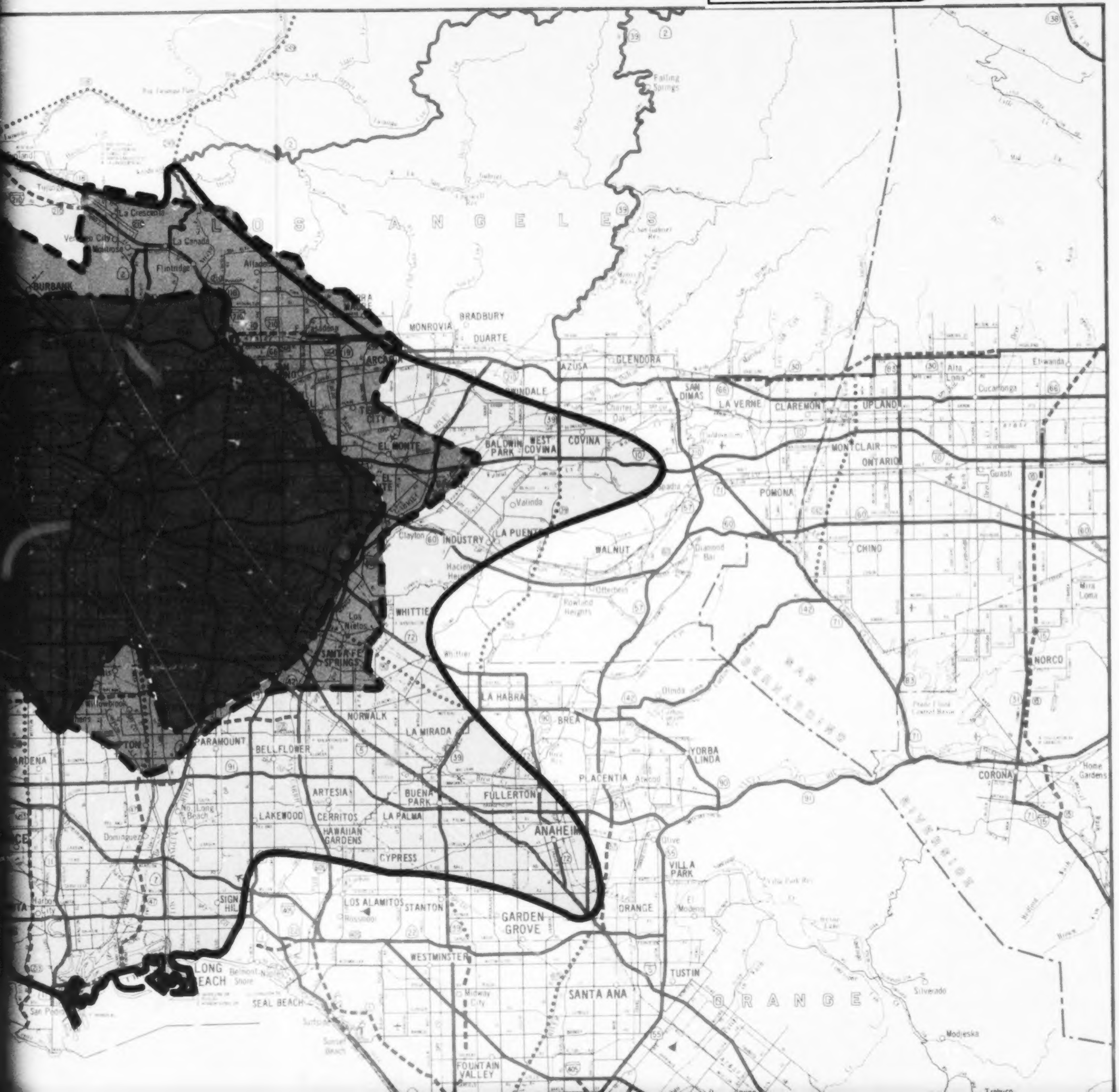
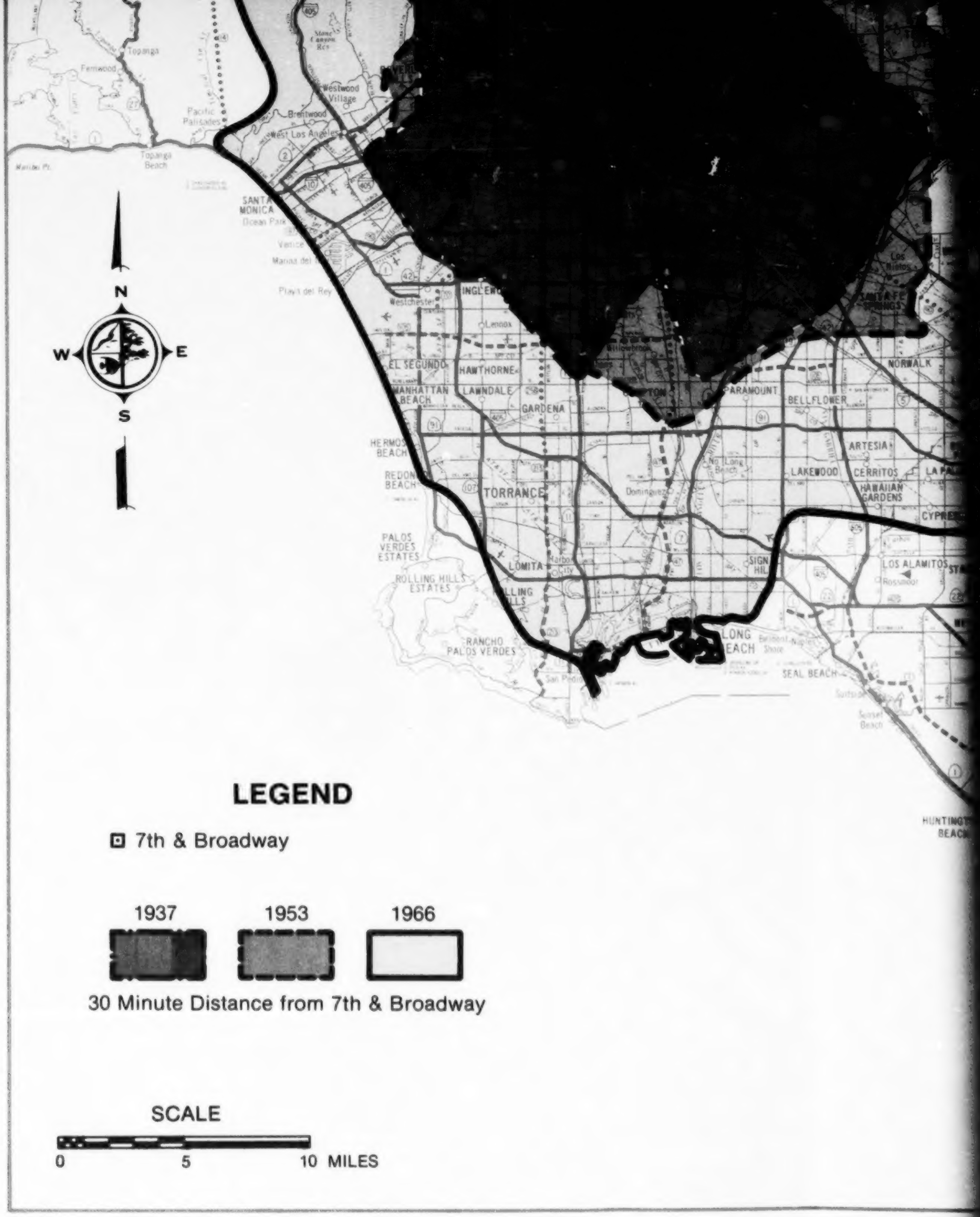
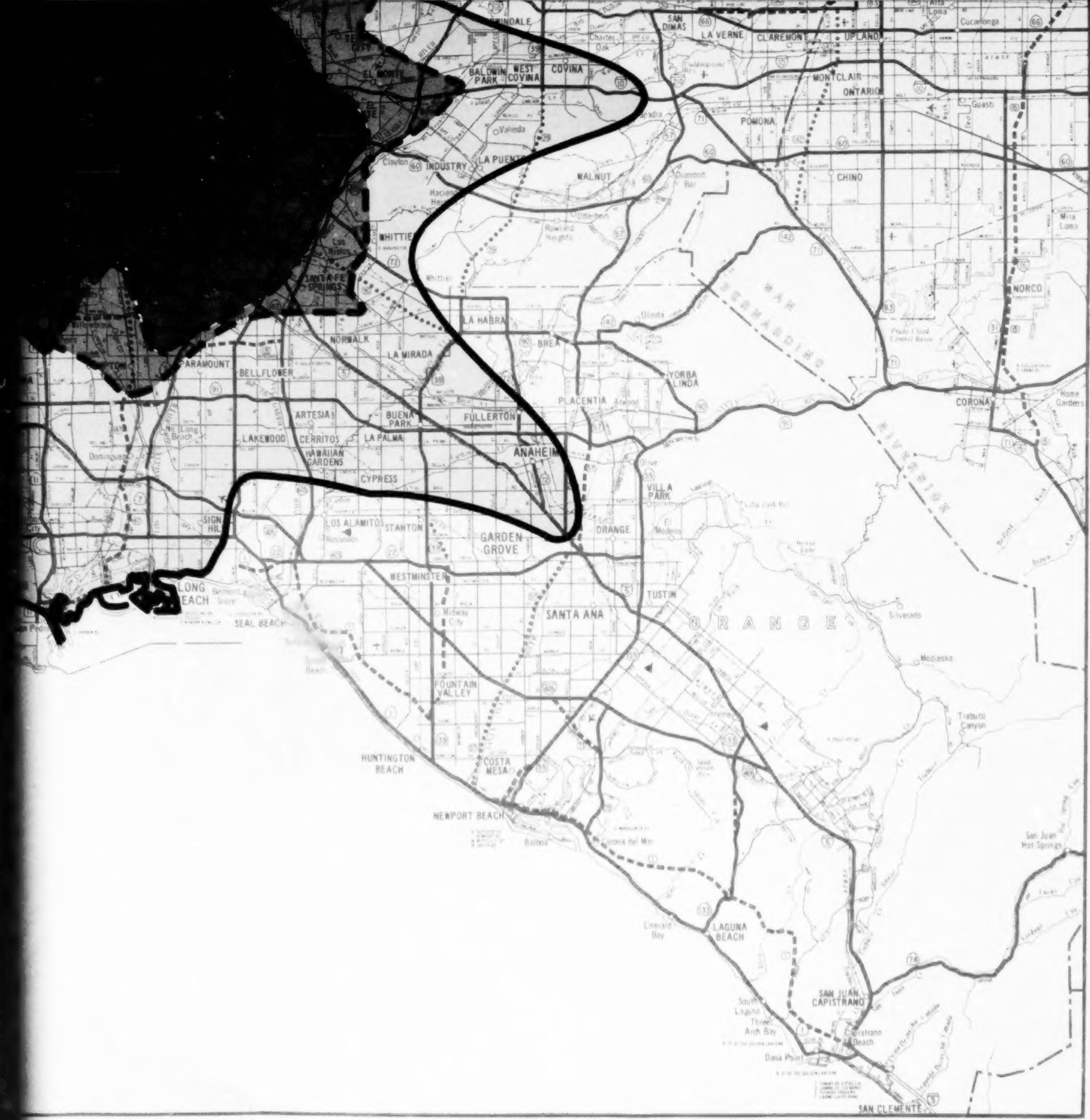

L O S A N G E L E S
Falling Springs
La Crescenta
La Canada
Montrose
Flintridge
Altadena
BURBANK
MONROVIA
BRADBURY
DUARTE
AZUSA
GLENDORA
SAN DIMAS
LA VERNE
CLAREMONT
UPLAND
Alta Loma
Cucamonga
Etiwanda
IRWINDALE
BALDWIN PARK
WEST COVINA
COVINA
Charter Oak
EL MONTE
MONTCLAIR
ONTARIO
Guasti
POMONA
Valinda
LA PUENTE
INDUSTRY
Clayton
WALNUT
Diamond Bar
CHINO
Mira Loma
Rowland Heights
WHITTIER
Los Nietos
SANTA FE SPRINGS
SAN BERNARDINO
NORCO
LA HABRA
BREA
NORWALK
LA MIRADA
PARAMOUNT
BELLFLOWER
ARDENA
YORBA LINDA
PLACENTIA
Atwood
CORONA
Home Gardens
ARTESIA
BUENA PARK
FULLERTON
LAKEWOOD
CERRITOS
LA PALMA
HAWAIIAN GARDENS
ANAHEIM
Dominguez
CYPRESS
Olive
VILLA PARK
RIVERSIDE
SIGNAL HILL
LOS ALAMITOS
Rossmoor
STANTON
GARDEN GROVE
ORANGE
El Modena
LONG BEACH
Belmont Shore
WESTMINSTER
TUSTIN
SEAL BEACH
Midway City
SANTA ANA
O R A N G E
Silverado
Modjeska
Sunset Beach
FOUNTAIN VALLEY
San Pedro



Topanga
Fernwood
Pacific Palisades
Topanga Beach
Westwood Village
Brentwood
West Los Angeles
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
Westchester
INGLEWOOD
Lennox
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
GARDENA
HERMOSA BEACH
REDONDO BEACH
TORRANCE
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
LOMITA
RANCHO PALOS VERDES
San Pedro
Dominguez
SIGNAL HILL
LONG BEACH
SEAL BEACH
PARAMOUNT
BELLFLOWER
NORWALK
ARTESIA
LAKEWOOD
CERRITOS
HAWAIIAN GARDENS
LOS ALAMITOS
Rossmoor
Sunset Beach
Los Nietos
SANTA FE SPRINGS
HUNTINGTON BEACH
N
W
E
S
LEGEND
⊡ 7th & Broadway
1937
1953
1966
30 Minute Distance from 7th & Broadway
SCALE
0
5
10 MILES

Figure II-120. Thirty-minute isochrones for downtown Los Angeles for the period 1937 to 1966.

C



SAN DIMAS
LA VERNE
CLAREMONT
UPLAND
Alta Loma
Cucamonga
BALDWIN PARK
WEST COVINA
COVINA
Charter Oak
MONTCLAIR
ONTARIO
Guasti
POMONA
Valinda
INDUSTRY
LA PUENTE
Clayton
WALNUT
Diamond Bar
CHINO
WHITTIER
Rowland Heights
Mira Loma
NORCO
SANTA FE SPRINGS
Los Nietos
LA HABRA
Olinda
BREA
SAN BERNARDINO
NORWALK
LA MIRADA
PARAMOUNT
BELLFLOWER
YORBA LINDA
PLACENTIA
Atwood
CORONA
Home Gardens
ARTESIA
BUENA PARK
FULLERTON
RIVERSIDE
LAKEWOOD
CERRITOS
LA PALMA
HAWAIIAN GARDENS
ANAHEIM
Dominguez
North Long Beach
CYPRESS
Olive
VILLA PARK
SIGNAL HILL
LOS ALAMITOS
Rossmoor
STANTON
GARDEN GROVE
ORANGE
Modena
LONG BEACH
Belmont Shore
SEAL BEACH
WESTMINSTER
TUSTIN
San Pedro
Midway City
SANTA ANA
ORANGE
Silverado
Modjeska
FOUNTAIN VALLEY
Trabuco Canyon
HUNTINGTON BEACH
COSTA MESA
NEWPORT BEACH
Balboa
Corona del Mar
San Juan Hot Springs
Emerald Bay
LAGUNA BEACH
SAN JUAN CAPISTRANO
South Laguna
Three Arch Bay
Capistrano Beach
Dana Point
SAN CLEMENTE

198P–187

4 P.

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D

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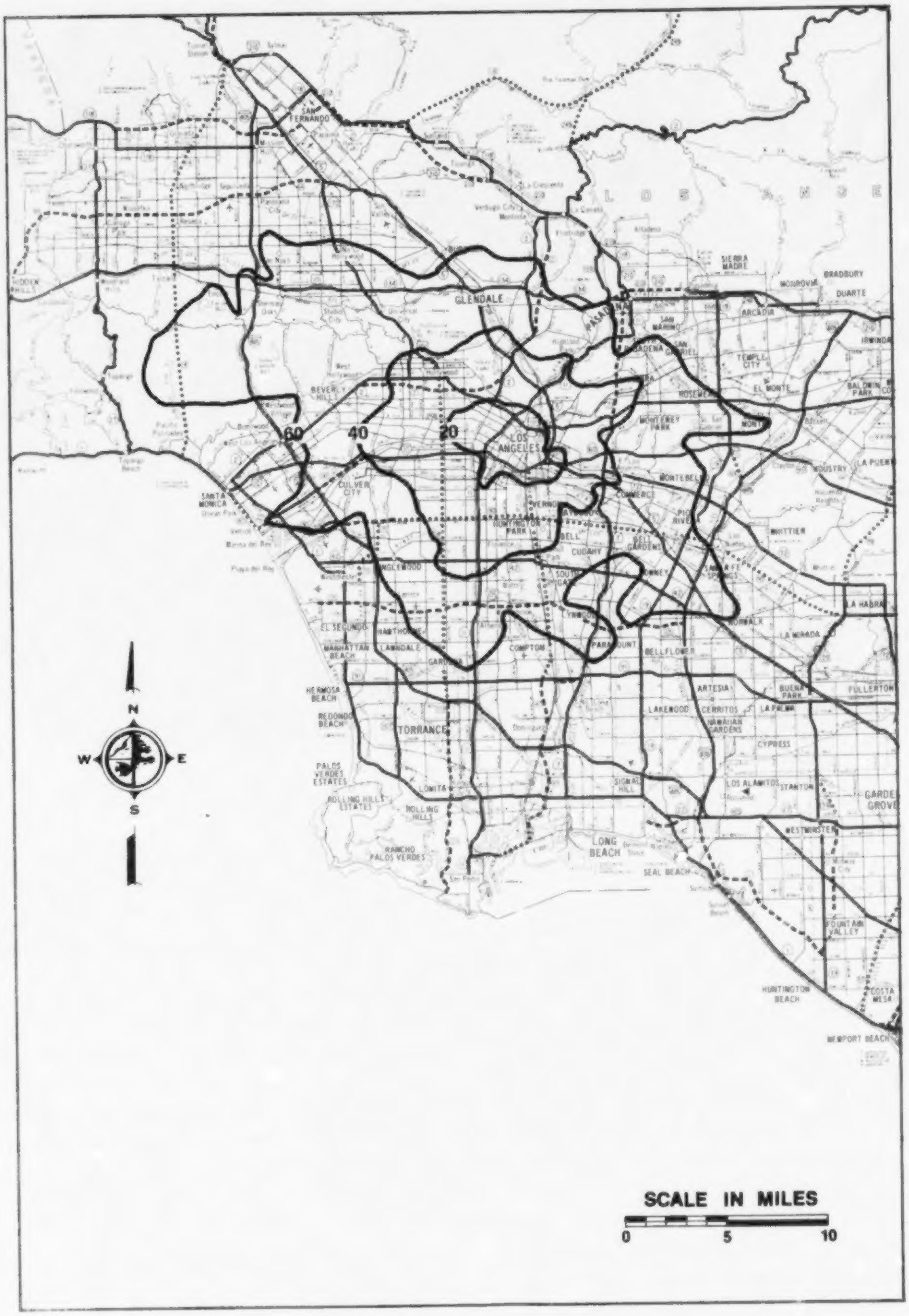
60
40
20
GLENDALE
PASADENA
LOS ANGELES
BEVERLY HILLS
SANTA MONICA
CULVER CITY
INGLEWOOD
HUNTINGTON PARK
MONTEBELLO
COMPTON
TORRANCE
LONG BEACH
WHITTIER
FULLERTON
N
S
E
W
SCALE IN MILES
0
5
10

Figure II-121. 1971 peak-hour transit travel time (20-minute isochrones) using SCRTD bus lines from 6th and Broadway.

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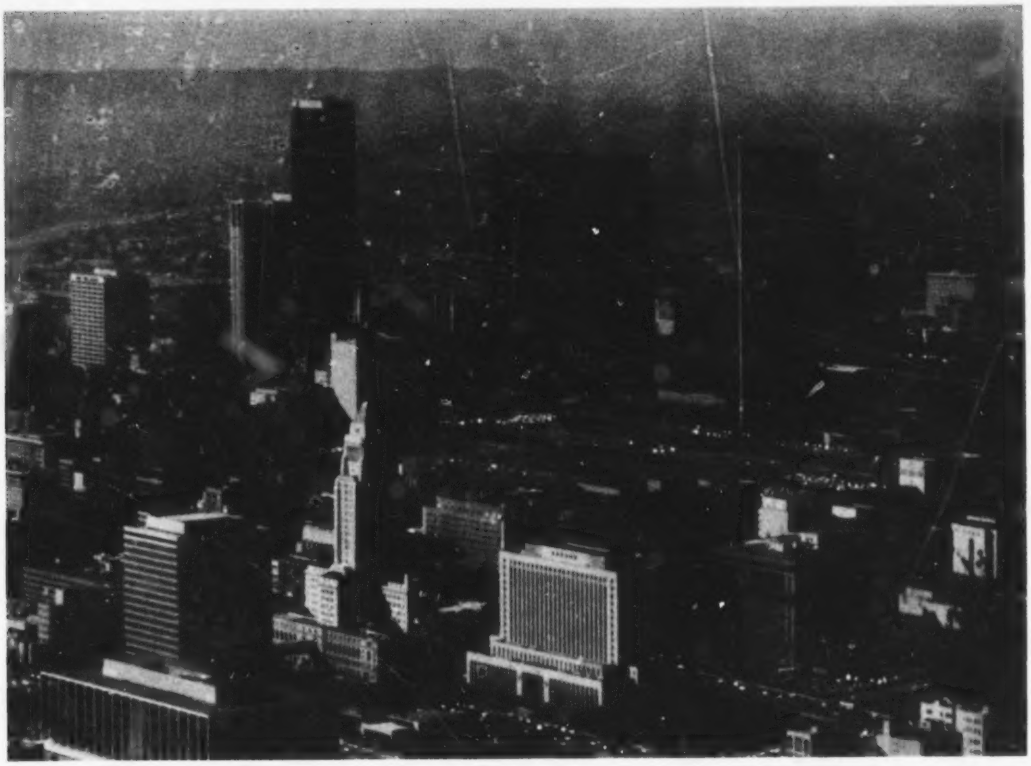
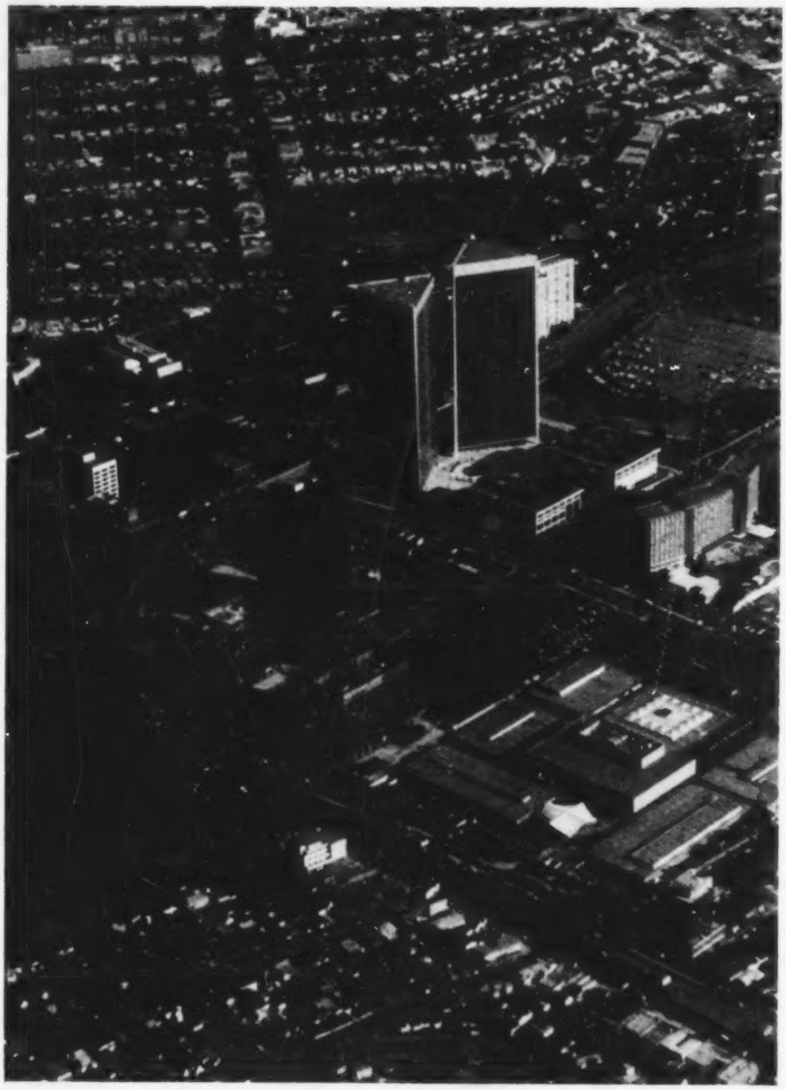


198P-189

Figure II-122. Oblique aerial view of Los Angeles CBD.

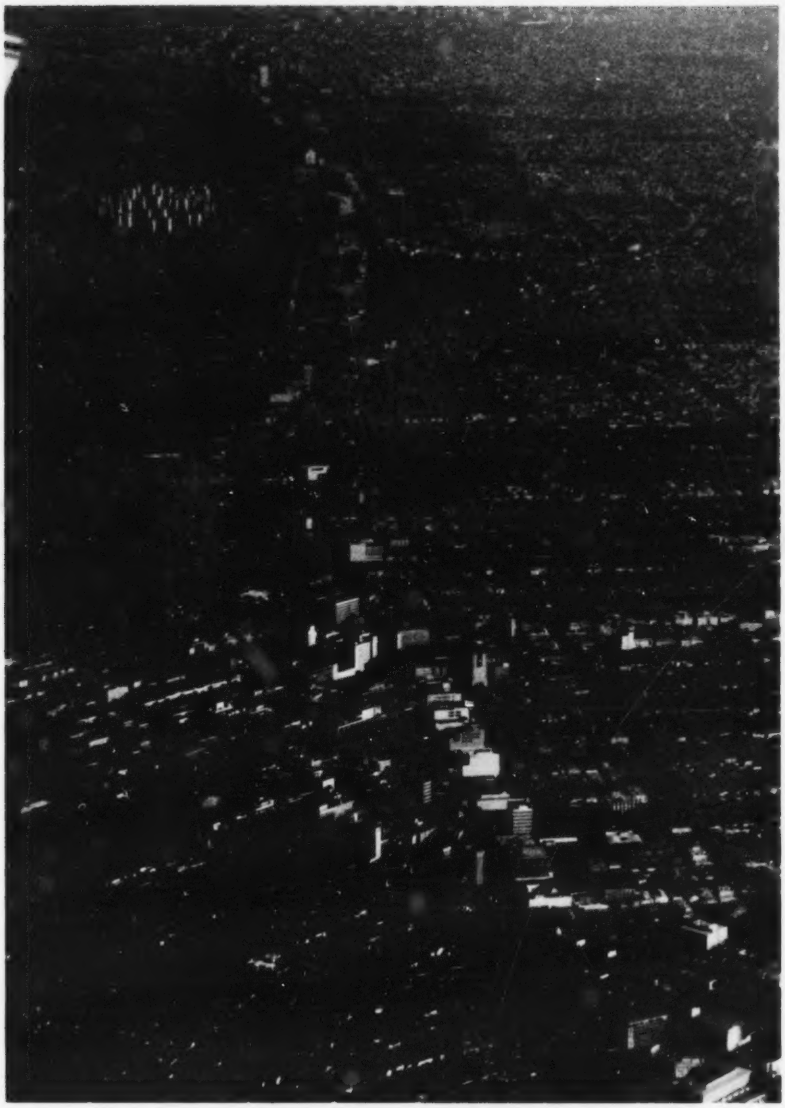
Pasadena, Long Beach, Orange County, Riverside, and San Bernardino. The majority of the important clusters within the City of Los Angeles is visible in Figure II-125, looking northwest toward the Santa Monica Mountains from the CBD. The CBD is in the foreground, Hollywood-Sunset is in the right background, the beginnings of the Wilshire Corridor are visible behind the CBD, and Beverly Hills, Century City, and Westwood are visible in the left background. Figure II-126 shows the office buildings along Ventura Boulevard on the north slopes of the Santa Monica Mountains in the San Fernando Valley. The view is southwest across the Sepulveda Flood Control Basin on the right and the industry built up along the railroad transportation system on the left. Local office nodes also exist in other areas throughout the region. Offices will continue to be built in all of these clusters, although there may be a decline in the relative proportion locating in the Los Angeles Central Business District (SCAG-75).

Retail trade in the region is characterized by dispersion. Less than one-fourth of the total activity is now taking place in concentrated areas such as shopping centers or major retail areas. The remainder occurs in small shopping areas, neighborhood stores, and strip commercial developments. This pattern can be expected to continue, with some increase in the proportion of activity in consolidated retail centers (SCAG-75).



198P-190

Figure II-123. Century City concentration.



198P-191

Figure II-124. Wilshire Corridor.

Figure II-125. Santa Monica Mountains from Los Angeles. 198P-192

Figure II-126. Office buildings on Ventura Boulevard. 198P-193

Industrial activity in the region also is dispersed with development clustered around rail lines, in the harbor area, and more recently, near major airports. Many research and development type industries are located in high amenity areas in order to attract highly skilled employees. Industrial/manufacturing concerns are likely to become even more dispersed, locating closer to their markets (SCAG-75).

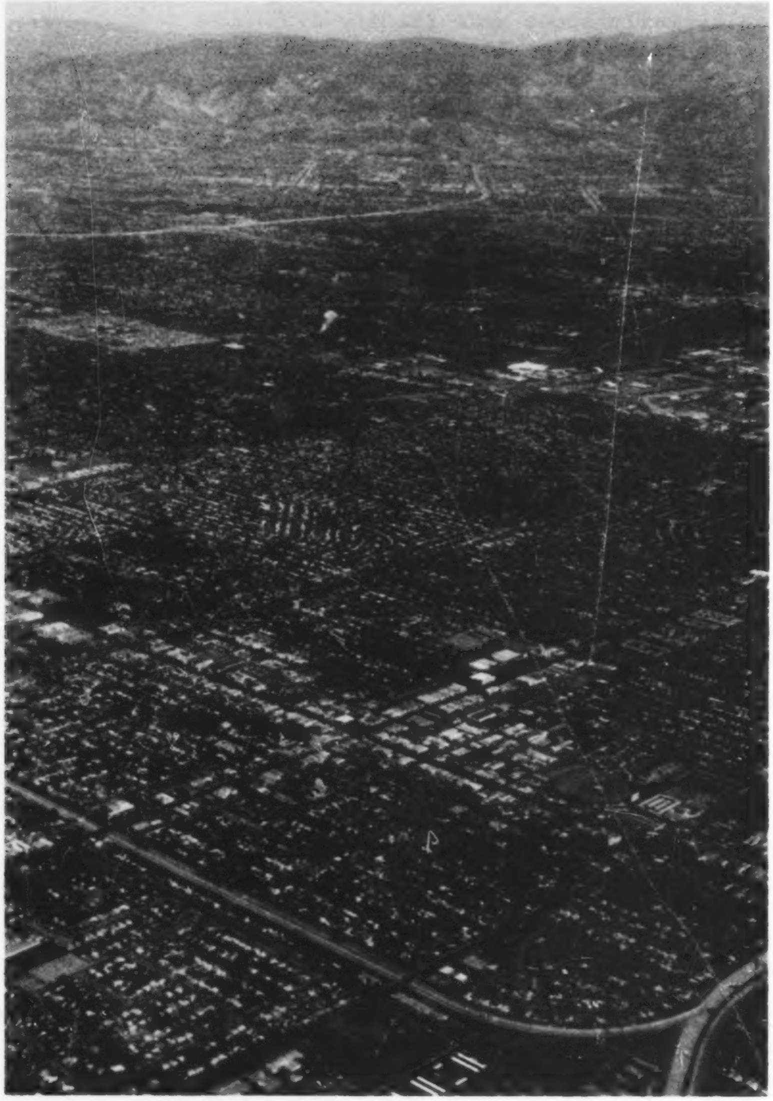
The ratio of single-family to multiple-family housing units was about 2 to 1 in 1970. Dwelling unit occupancy averaged 2.9 persons, and residential density 5.4 dwelling units (including vacant and occupied units) per residential acre. The dwelling unit mix has relatively more single-family units, especially in the outlying counties of the region where land prices are comparatively lower (SCAG-75).

(1) TRANSPORTATION TRENDS AND PROBLEMS. Like most metropolitan areas throughout the nation, the Los Angeles region is faced with many complex transportation problems. Due to a variety of economic and social forces and historical patterns, the urban form of Los Angeles is characterized by low density development. This low density, homogeneous development is clearly evident in Figure II-127, a view north across the San Fernando Valley with the beginnings of the Los Angeles River in the right foreground. Such development is atypical of most older major cities, which generally have more concentrated development. The most significant current trends which contribute to the region's transportation problems are:

- dependency on the private automobile, and
- tendency toward greater distances between places of employment and residence.

The predominant trend in transportation in the Los Angeles region has been the ever-increasing dependency upon the private automobile. Public bus transportation has not been able to provide adequate regionwide service largely due to the low density of population and the spread-out nature of Los Angeles. As a result, Los Angeles has developed one of the most comprehensive networks of streets, highways, and freeways in the world in order to accommodate existing and growing traffic demands. It is also becoming increasingly evident that the freeways alone will not adequately handle tremendous existing and future demands of rush hour travel unless average vehicle occupancy can be increased through carpools and buses.

While vehicles on the freeway system operate at high speeds during off-peak hours, speeds drop and stop-and-go conditions exist during peak periods of travel (7:00 to 9:00 a.m., and 4:00 to 6:00 p.m.), largely due to commute trips. Traffic congestion is most severe on highways and freeways serving the regional core, where the greatest employment density exists (see Figure II-128)(Department of City Planning, 1970).



198P-194

Figure II-127. View north across the San Fernando Valley.

Another major trend contributing to transportation problems in Los Angeles is the ever-increasing distance between place of employment and place of residence. Most of the population growth in Los Angeles during the last two decades has occurred in outlying suburban areas where numerous new single-family homes were readily available (see Figure II-129). However, the increase in employment in those areas has lagged far behind. Consequently, workers have had to commute greater and greater distances to work. A great many of the highways and freeways have been built to provide convenient access from suburbs to the older urban area. This, in turn, has allowed the continued outward growth of the urbanized area.

A major concentration of employment in Los Angeles is found within the regional core, which includes the area from the Central Business District west to Beverly Hills, and from Hollywood south to about the Santa Monica Freeway (see Figure II-128). This area continues to be a major traffic generator of the region and is the only area of its size which has a large net import of labor (SCAG-74).

(2) PAST AND PRESENT EFFORTS TO REDUCE VEHICLE MILES TRAVELED AND EMISSIONS. As the population grew in Los Angeles and the use of the automobile increased, programs designed to either reduce delays, conserve fuel, or reduce emissions were undertaken. Delay reducing techniques include road widening, ramp metering and using computer technology to operate traffic signals. Techniques to conserve fuel or reduce emissions generally depend on increasing the average occupancy rate of vehicles. Preferential treatment is given to buses and carpools at freeway on-ramps, freeway lanes, or City street lanes.

(a) Highway Related Controls. Ramp metering and preferential lanes for high occupancy vehicles are two freeway related controls that may reduce emittants associated with VMT or delay. The ramp metering concept reduces congestion on freeways by:

- controlling traffic flow to bottlenecks thereby maintaining higher average speeds, and
- diverting vehicles to under-utilized surface streets.

In stretches of freeway where demand greatly exceeds capacity, freeway widening may be included in the ramp metering project. Then the ramp metering rates can be set to prevent additional vehicles from being attracted to the free-flowing freeway. Where widening is not called for, metering rates are set to the maximum allowable for a free-flowing freeway.

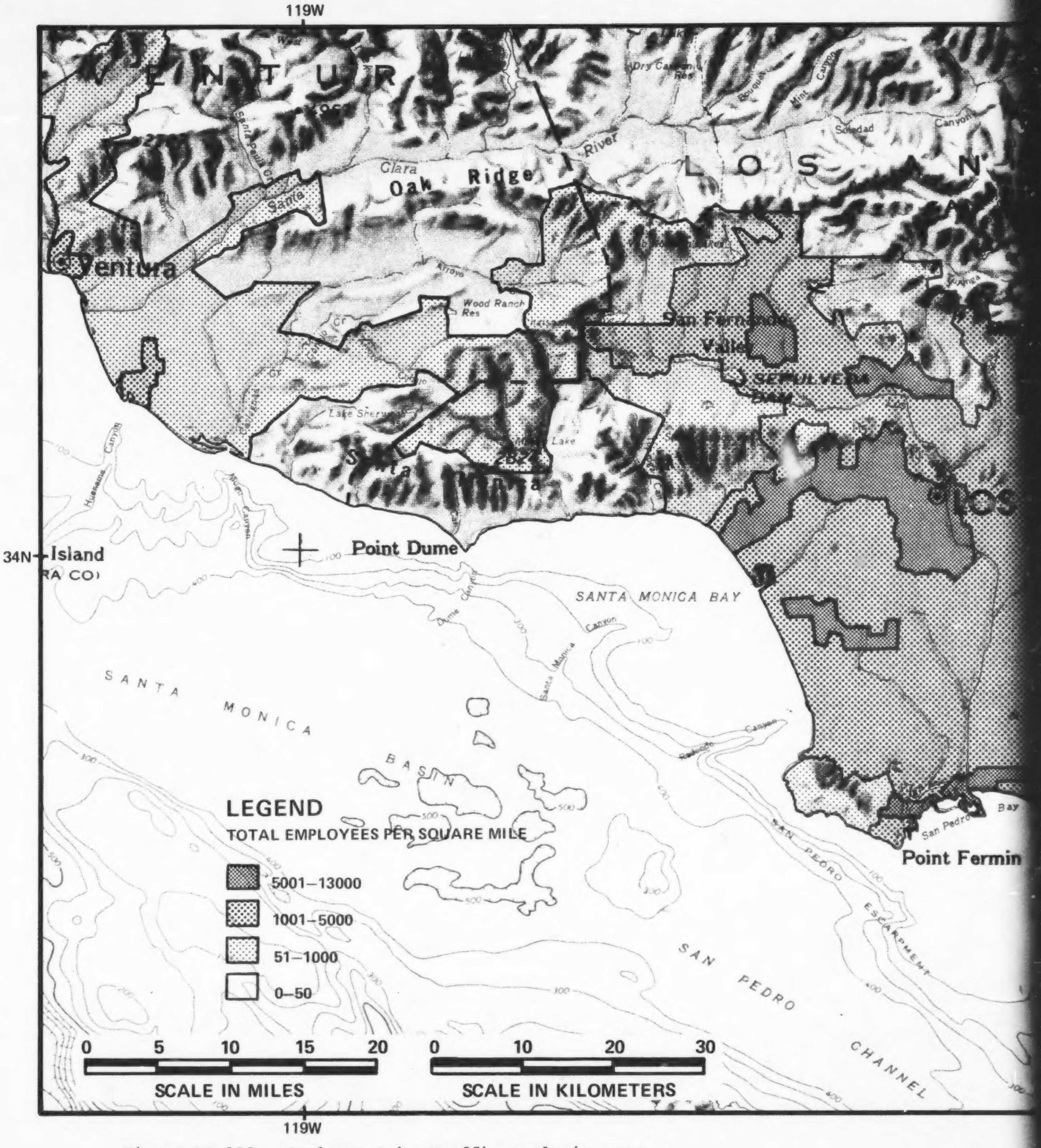
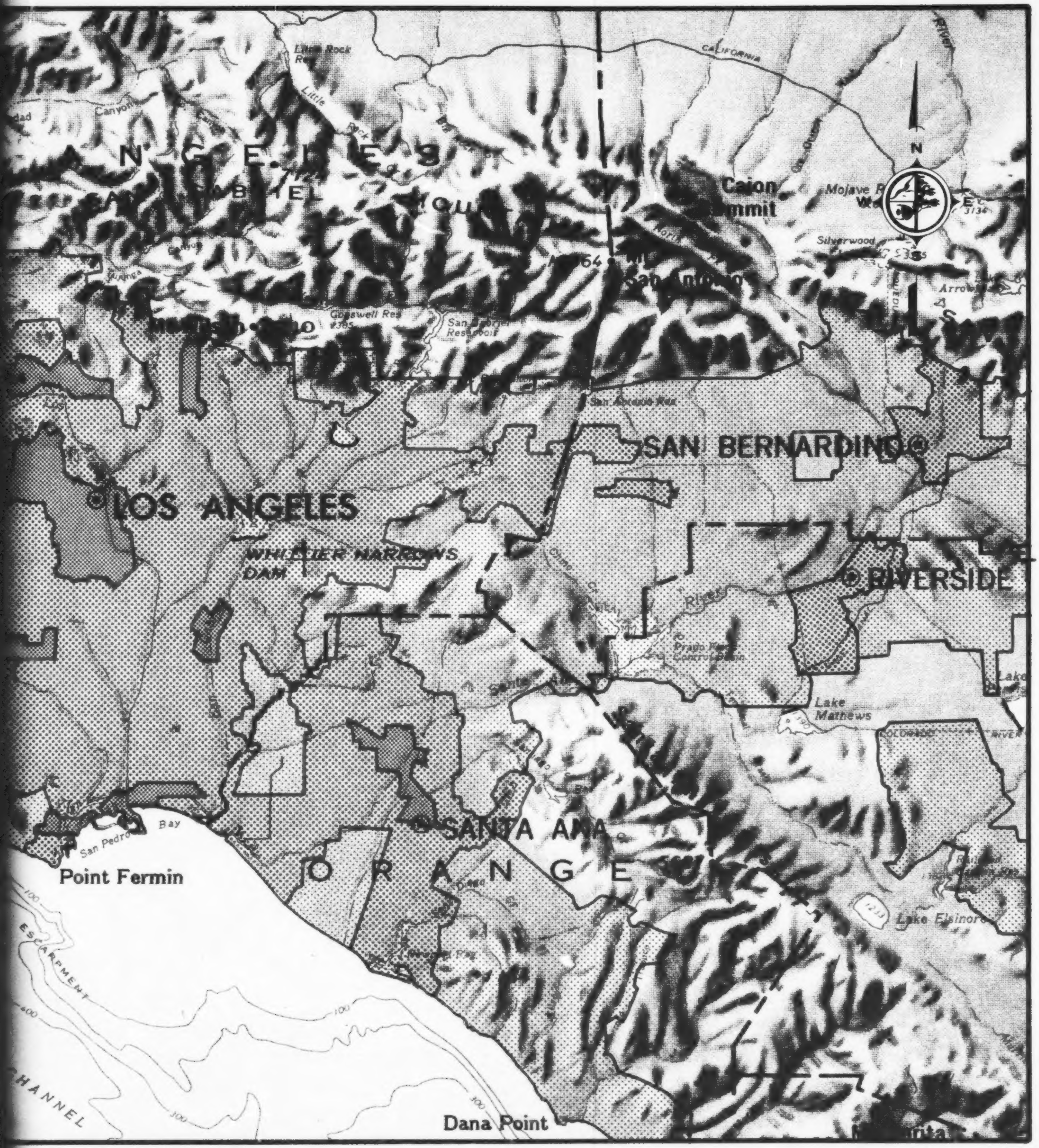

119W
V E N T U R
L O S A N
Oak Ridge
Clara
Santa
River
Dry Canyon Res
Bouquet
Mint Canyon
Soledad
Canyon
Ventura
Arroyo
Wood Ranch Res
San Fernando Valley
SEPULVEDA DAM
Lake Sherwood
Lake
Santa Monica
LOS
34N
Island
Point Dume
Hueneme Canyon
Mugu Canyon
SANTA MONICA BAY
Dume Canyon
Santa Monica Canyon
Redondo Canyon
SANTA MONICA BASIN
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
San Pedro
Bay
Point Fermin
LEGEND
TOTAL EMPLOYEES PER SQUARE MILE
5001–13000
1001–5000
51–1000
0–50
0 5 10 15 20
SCALE IN MILES
0 10 20 30
SCALE IN KILOMETERS
119W

Figure II-128. Employment by traffic analysis zones.


Little Rock Res
Little Rock
CALIFORNIA
Canyon
A N G E L E S
SAN GABRIEL
MOUN
Cajon Summit
Mojave R
N
E
S
3136
Silverwood
Arrowhead
Mt San Antonio
Cogswell Res
San Gabriel Reservoir
San Antonio Res
SAN BERNARDINO
LOS ANGELES
WHITTIER NARROWS DAM
34N
RIVERSIDE
River
Prado Flood Control Basin
Santa Ana
Lake Mathews
COLORADO RIVER
Bay
San Pedro
Point Fermin
SANTA ANA
O R A N G E
Lake Elsinore
ESCARPMENT
CHANNEL
100
400
300
Dana Point

198P-195

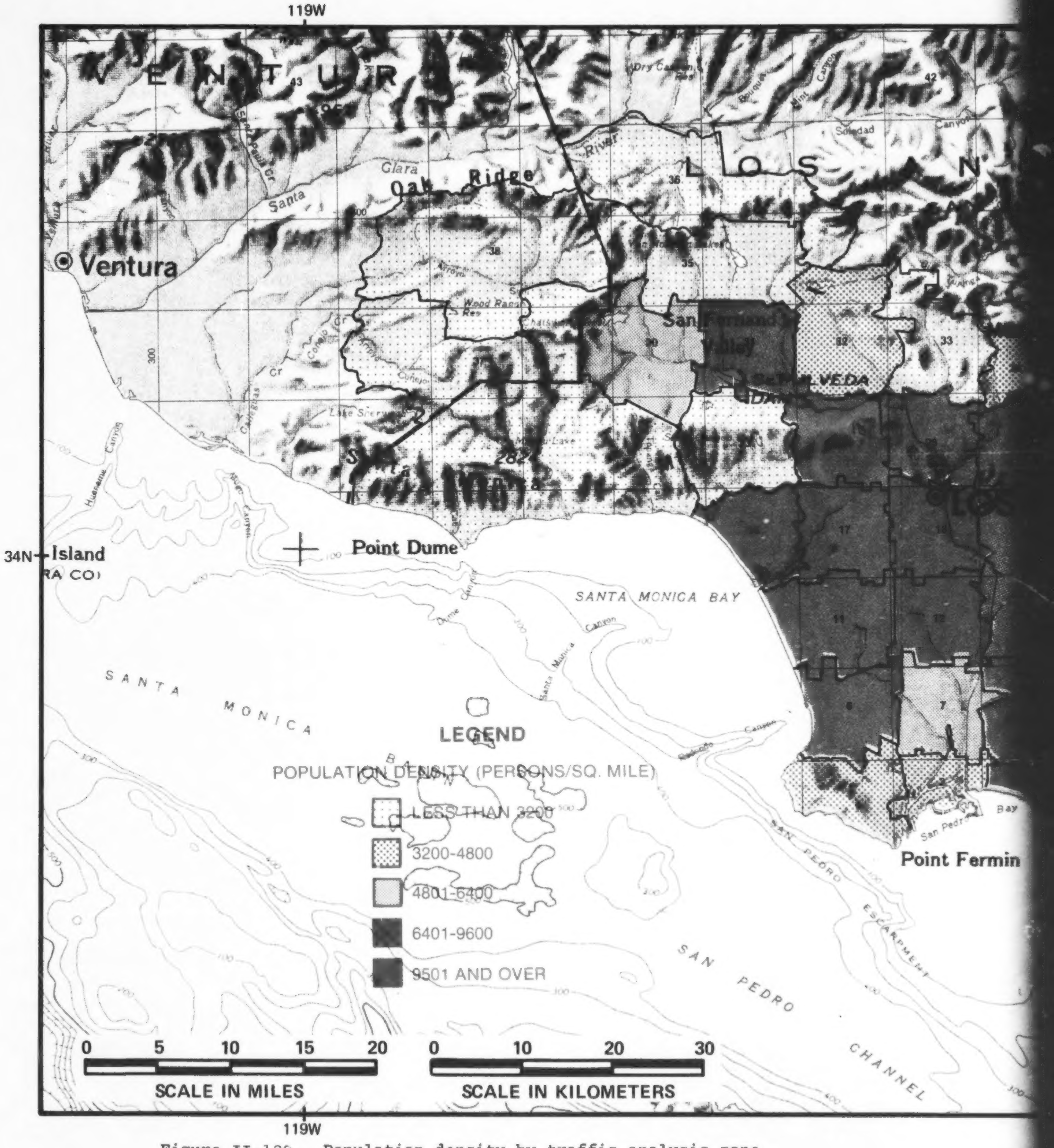
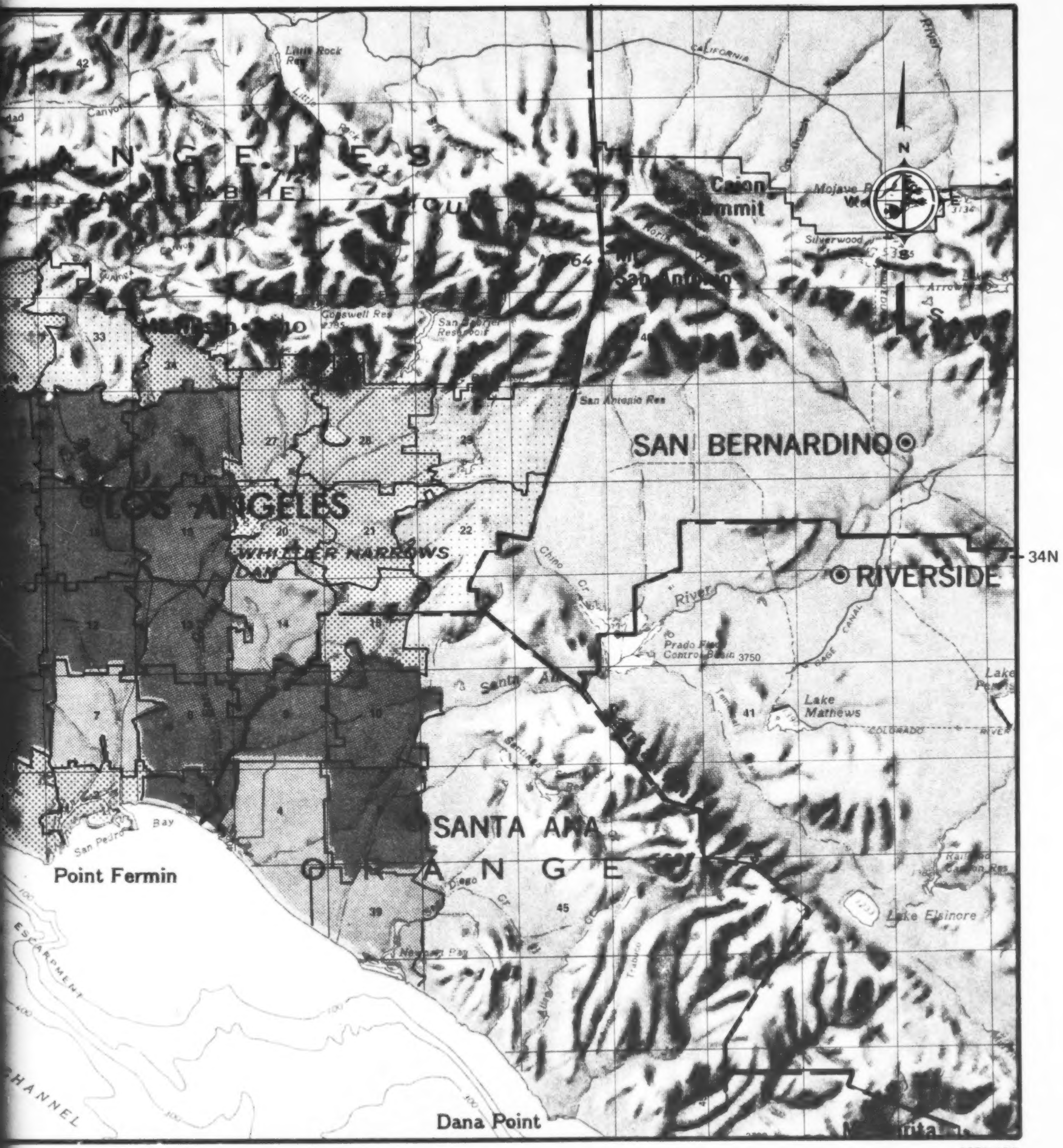

119W
VENTURA
LOS AN
Ventura
Oak Ridge
Santa Clara River
San Fernando Valley
SEPULVEDA DAM
Point Dume
Island
SANTA MONICA BAY
SANTA MONICA BASIN
Point Fermin
San Pedro Bay
SAN PEDRO ESCARPMENT
SAN PEDRO CHANNEL
34N
LEGEND
POPULATION DENSITY (PERSONS/SQ. MILE)
LESS THAN 3200
3200-4800
4801-6400
6401-9600
9501 AND OVER
0 5 10 15 20
SCALE IN MILES
0 10 20 30
SCALE IN KILOMETERS
119W

Figure II-129. Population density by traffic analysis zone.


Little Rock Res
CALIFORNIA
River
42
Canyon
ANGELES
SAN GABRIEL
Cajon Summit
Mojave
Silverwood
N
E
S
Cogswell Res
San Gabriel Reservoir
Mt San Antonio
33
34
40
San Antonio Res
27
28
29
SAN BERNARDINO
LOS ANGELES
19
20
21
22
WHITTIER NARROWS DAM
34N
RIVERSIDE
Chino Cr
River
Prado Flood Control Basin 3750
12
13
14
15
Santa Ana
7
8
9
10
41
Lake Mathews
COLORADO RIVER
Lake Perris
San Pedro Bay
4
SANTA ANA
ORANGE
Point Fermin
Diego Cr
39
45
Newport Bay
Railroad Canyon Res
Lake Elsinore
Trabuco
ESCARPMENT
CHANNEL
100
400
Dana Point

198P-196

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Excess vehicles, particularly those being used for short trips, are diverted to surface streets. Projects in the South Bay area of Los Angeles County have shown substantial vehicle-minutes saved by ramp metering (Gordon, 1973).

Preferential lanes for high occupancy vehicles is another technique being tried in the Los Angeles area to reduce VMT or delay. Present strategies call for constructing new lanes in the medians of freeways or reserving existing lanes for buses and high occupancy vehicles during the rush hours. A high occupancy vehicle would either be a carpool with three or more passengers or a bus. Also, special lanes would be constructed to allow high occupancy vehicles to bypass the queue at metered on-ramps. Preferential lanes are expected to be free-flowing, thus reducing travel times. The presence of a free-flowing lane during the rush hours is expected to encourage greater carpooling and transit urbanization, thus reducing VMT and excess emissions caused by delays.

Two preferential freeway lanes have been recently in operation in Los Angeles. They are the Diamond Lane on the Santa Monica Freeway and the El Monte Busway on the San Bernardino Freeway. The Diamond Lane, reserved during the rush hours for buses and carpools containing three or more persons, was created by painting a diamond containing the digit "3" on the existing fast lane (inbound and outbound) and erecting signs specifying the hours of operation. No physical barrier separates the Diamond Lanes from the other lanes. This has created concern for safety with vehicles merging from the slow moving lanes into the relatively fast moving lanes. Figures supplied by CALTRANS and the SCRTD show there were 506 carpools traveling inbound on the project's first day—March 15, 1976; on April 9 there were 822. Patrons using SCRTD and SMMBL buses numbered 1,655 April 9, up from 1,001 March 15. (Typically one lane of freeway can accommodate 1,800-2,000 vehicles per hour during the peak periods.) Meanwhile, patronage from three park-and-ride lots established by the SCRTD in east Santa Monica, Fox Hills, and Century City has climbed from 141 the first day to 288 April 12. Although there has been a good deal of adverse publicity, it is too early to evaluate the concept of reserving an existing lane for high occupancy vehicles. Construction is underway on a third route, the San Diego Freeway, to convert the median to use by buses and carpools, to widen the bottlenecks, and to meter the on-ramps.

The City has cooperated with the Department of Transportation in implementing these programs and has created preferential lanes for buses on several downtown city streets. In these cases, one lane of one-way streets has been reserved for contraflow of buses.

The El Monte Busway was created by constructing new lanes in the median of the San Bernardino Freeway. The lanes are separated from the normal lanes by a shoulder and traffic cones. Presently, rapid transit buses operate from the terminal in El Monte to downtown Los Angeles. During a Southern California Rapid Transit District (SCRTD) labor strike, carpools were permitted to use the bus lanes.

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Table II-64 shows the El Monte Busway experience with preferential lanes before and during the SCRTD labor strike. Before the strike, only special permit buses were allowed to use the preferential lane. When the bus drivers went on strike, the Department of Transportation (CALTRANS) temporarily permitted carpools with greater than two persons to use the lane. In the future, as part of the evaluation of the preferential lane concept, the CALTRANS will allow both buses and carpools to use the lane simultaneously. With this combined operation, one lane of highway can carry an additional 2,250 passengers/hour.

Table II-64. Preferential land flow rates during a.m. peak hour on El Monte Busway (Department of Transportation, 1975).

VEHICLE TYPE	WITHOUT PREFERENTIAL LANE		WITH PREFERENTIAL LANE	
	PASSENGERS	VEHICLES	PASSENGERS	VEHICLES
Low occupancy cars only (1.2 pass./veh.	2,160	1,800	--	---
Bus only (42.2 pass./bus)[1]	--	--	2,910	69
High occupancy cars only (3 pass./car)[2]	--	--	1,500	500
Bus plus high occupancy cars	--	--	4,410	569

[1] Before SCRTD Strike.
[2] During SCRTD Strike.

Reduction of total emissions is complicated by the question of whether the 2,250 additional passengers/hour will come from the normal freeway commuter (thus reducing VMT) or would come from the commuters that would have used alternate routes or modes of transportation. If an existing lane of freeway is taken for a preferential lane and commuters are not diverted to carpools or buses, then increased congestion and emissions could occur.

The automobile, modified to conform to the adopted air quality standards and with improved efficiency to cope with higher cost fuels, is expected to continue to be the dominant form of transportation in Los Angeles County. An attractive possibility for reducing the frequency of usage, especially in view of the recent fuel shortage experienced, would be to increase commuter carpooling.

The following procedures have been incorporated to stimulate carpooling:

- Computers have been used to establish a data base time-table handling and locate partners for similar sources and destinations.

- Costs of data acquisition and dissemination and enforcement of preferential treatment would be paid through gasoline taxes.
- Companies have assisted employees in forming carpools by distributing lists to each employee of 10 fellow members near them.
- Carpool autos receive preferential freeway on-ramp lane, and parking treatments in certain instances.

The results of such procedures are summarized in a 1975 SCAG study:

> Accomplishments have been very positive in the Carpool Action Program. The Commuter Computer Corporation has successfully established a sizeable matching file capability and has been providing an efficient matching service to the public. By mid-1975 more than 65,000 applicants were in the data base, and it is estimated that 6 percent more of these applicants are in carpools. Unfortunately, the progress made in carpooling has rather low visibility to the public because of the nature of the service. This low visibility has also been compounded because of delays in the start of carpool support programs which make up a large share of the carpool incentive measures. Typical of this is the start of the freeway preferential lane program and associated park-and-ride lots. Considerable publicity for carpooling with the opening of the Santa Monica preferential lane will provide greater impetus to carpooling (Southern California Association of Governments, 1975 Regional Transportation Plan, 1975).

To reduce delays at signalized intersections, more sophisticated controllers are being installed. The access to City street intersections can be controlled by (1) signing, (2) pre-timed controller signal operation, (3) traffic actuated controller signal operation, or (4) computer controlled signal operation. The simplest device is the stop or yield sign. Here the driver waits for an acceptable gap in traffic before he proceeds into the intersection.

The pre-timed controller divides the green time between the various legs of the intersection based on average traffic demands on each leg. The traffic actuated controller permits the cycle length and splits to vary in accordance with moment-by-moment traffic counts. The more sophisticated traffic control systems are computer controlled. The computer control system divides the green time available at each intersection in accordance with the traffic demands on each approach and it relates the green time interval at successive intersections in a manner which would minimize the number of stops and delays to through traffic. The computer system detects congestion and takes steps to reduce inflow to congested areas and increase outflow from congested areas.

The City's Traffic Engineering Department designs control systems to minimize delay and congestion which in turn minimizes vehicle emissions. Wherever traffic patterns change, steps are taken to reduce delay using the appropriate control systems.

(b) Transit Measures. Three basic types of bus system improvements can be employed for reducing VMT (RAND Corporation, 1974):

- Reduction in fares.
- Increased frequency of service.
- Expanded service areas.

The first two types of improvements are designed to make transit more attractive so that some trips presently made in automobiles will be switched to the bus mode. The third type of improvement simply increases the availability of bus service to areas not presently served. The impact of gasoline price increases will depend on the level of bus system improvement being considered. According to a recent RAND report, large VMT reductions can be realized if gasoline becomes quite expensive. Using a reference case bus system, a 20 percent reduction in VMT is projected if gasoline were $0.85 per gallon (RAND Corporation, 1974).

The Los Angeles County Board of Supervisors has voted substantial subsidies to the Southern California Rapid Transit District (SCRTD) to maintain a $0.25 fare. The low fare plus expanded grid service on virtually all the major arterials in the City provides accessibility to large segments of the population.

During the past few years there has been a need to improve bus service in the Basin, first to provide increased accessibility and mobility, and second to provide an alternative to the automobile as a means for conserving energy and minimizing emissions by reducing vehicle miles traveled. The effort to improve bus service involves increasing the frequency of service and extending service to more areas of the Basin.

The City of Los Angeles Traffic transit analysis shows that in the San Fernando Valley approximately 1 percent of the trips are accomplished using public transit and the Southern California Association of Governments' 5-year goal for the entire region is 6 percent. This represents a saturated bus system, or the maximum possible ridership given the rate at which buses can be obtained from manufacturers and resources to pay for keeping the buses operational.

The following procedures could be implemented to increase ridership. Again, it must be recognized that these procedures are not costless and require a strong commitment of community resources.

- The use of a "bus only" lane on local freeways.
- Limit private parking in City centers and provide compensatory peripheral parking with distribution by public transit.
- Reduce or eliminate bus fare.
- Provide "park-and-ride" systems where regular bus service would be impractical such as in steep, hilly areas.

- "Dial-a-ride" service could be subsidized in areas where regular bus service would be difficult to implement.

Minibuses carry fewer than 20 passengers and are primarily intended to provide short trip service in downtown areas of shopping centers. It is unknown how minibus service effects VMT, since the shorter trips can be made by walking and the slightly longer trips may have been foregone without the service. Minibus service is provided by the SCRTD in Downtown Los Angeles and by other transit districts for other communities.

Two employer sponsored plans entail the use of subscription buses or van pools. In both instances, employees make an agreement to commute together on a regular basis, small numbers by van, larger numbers by bus. The employer would subsidize a portion of the fare. The system is similar to a carpool and is especially worthwhile in providing long distance service to large employment centers. The Atlantic Richfield Company (ARCO) is currently participating in a subscription bus service with the SCRTD. SCRTD supplies twelve buses on eight routes from such suburbs as Fullerton, Westlake Village, and Woodland Hills. About 400 employees (out of 2,000) use this service to the Downtown Los Angeles office. ARCO subsidizes $15 per month towards the SCRTD fares and the rider pays the remainder (up to $65 per month total for the longest routes). ARCO also has 92 employees using eleven vanpools to the Wilshire office. Vanpools are organized by the Commuter Computer Corporation and ARCO pays them a flat rate.

Fixed route mass transit has its optimum advantages for long hauls during peak load periods. The public transit auto or "Jitney" offers great advantages on short hauls without fixed routes.

> Jitney service in the City of Los Angeles is governed under City Ordinance No. 141.670, and Board of Public Utilities and Transportation Orders. Jitneys are defined as a type of motor bus, which also includes automobiles, stage and autostage and every other motor-propelled vehicle "owned, controlled, operated, and managed for public use in the transportation of persons, for compensation, over any public street in the City of Los Angeles and into which passengers are received and from which passengers are discharged along the route traversed by such vehicle."
>
> Although the City of Los Angeles' policy is to encourage jitney operations, the two major lines which have been attempted have failed - Fred La France and the Yellow Cab Wilshire Jitney. These failures were attributed to lack of patronage and competition with SCRTD lines (Southern California Association of Governments, 1976; Regional Transportation Plan, 1975).

Several urban authorities and government transportation planners have called such a system essential to any "balanced" transportation program. Jitneys can offer lower fares than the transit system on short hauls thus expanding options beyond the private automobile. Using the Centers concept as an example, this approach would contribute to reducing numbers of trips and vehicle miles traveled in the study area.

The dial-a-ride system is similar in operation to taxi service. The transit patron calls the transit company on the telephone and requests to be picked up. A small bus or van is then dispatched to that person's location, picking up other riders along the way. The bus has no fixed route, but generally takes riders from residential areas to local business centers. The dial-a-ride system is especially applicable for service to the physically limited (elderly, handicapped, etc.) and in areas with population densities too low to justify fixed route, scheduled service. The major impact of dial-a-ride systems on reducing VMT would be in reducing the home-to-shopping trips.

The park-and-ride concept involves a parking lot on the outskirts of town that is a hub for transit routes. Presently, a park-and-ride system is operating on the El Monte Busway and Diamond Lanes. Commuters either drive to the park-and-ride lot and leave their cars, or are delivered by a bus or dropped off by a family member. Then the commuter rides a bus Downtown on a preferential freeway lane. Another park-and-ride system connects the San Fernando Valley with Los Angeles International Airport.

c. Transportation Planning.

(1) INTRODUCTION. Transportation planning begins by establishing community goals concerning accessibility, safety, degree of choice, comfort, impact on land use, and economic growth. The planning process involves attempting to optimize the quality of life given limited resources. Transportation planning addresses a number of mandates or responsibilities, including: the provisions of state and federal laws, the need for comprehensive planning providing for coordination of functional planning elements, the preeminent transportation-related air quality and energy problems, and the demands for improved public transportation (SCAG-75).

Transportation planning activities are within the responsibilities of many jurisdictions. Every level of government and many special purpose agencies, districts, and commissions are involved in planning, implementing, and monitoring the many related aspects of the overall transportation system. At the state level the Department of Transportation (CALTRANS) is responsible for developing the State Transportation Plan.

The State Transportation Plan will be based on 41 regional transportation plans in what is referred to as a "bottoms up" process; the regions are to develop plans based on consideration of City and County transportation plans. The regional plans, in turn, will form the basis for the State Transportation Plan. CALTRANS is preparing the plans for 24 of the 41 regional transportation planning agencies. In addition, CALTRANS is providing significant technical expertise to all regions.

The Transportation Goal of the state is the development, coordination, and maintenance for a transportation system that provides the optimum capability for the movement of people and goods, in the most efficient, convenient, timely, safe, reliable, and cost-effective manner consistent with social, economic, and environmental interests of the state.

The Transportation Board further defines "consistent with social, economic, and environmental interests" as:

> ...the necessity to identify and evaluate the effects which the transportation system - existing and proposed - will have on the non-transportation interests of society, prior to adoption of any particular alternative. This does not imply that the transportation network alone could or should directly solve social, economic, or environmental problems; simply that these issues must be incorporated in the transportation planning process and will affect transportation decisions (California Air Resources Board, 1974).

SCAG is the federal- and state-designated regional planning agency for the six Southern California Counties of Los Angeles, Orange, Ventura, San Bernardino, Riverside, and Imperial. SCAG coordinates with CALTRANS and subregional planning agencies. The California Coastal Zone Commission prepares transportation elements for their coastal plans and they are included in the Regional Plans. The Southern California Rapid Transit District performs regional mass transit planning. On the subregional level, the County and City of Los Angeles prepare transportation elements as input to their general plans.

The development and refinement of goals, policies, and objectives is an ongoing part of the region's transportation planning process. The County's and City's policies and goals provide the general parameters of the regional transportation system. That system must discourage sprawl by de-emphasizing long trips and by minimizing access to those peripheral areas where new development is not desired. A high level service for short trips, particularly community and activity center trips, must be provided (RAND, 1974).

It is the policy of the City of Los Angeles that (Bradley, 1975):

FREEWAYS

- Freeways create minimum disruption of areas which they traverse, and be routed so as to separate incompatible land uses where possible. Freeways should not split cohesive residential neighborhoods or commercial complexes.
- Freeway rights-of-way be designed to accommodate other compatible modes of transportation. Utilization of air and surface rights on unused rights-of-way under elevated roadways will be encourged.

- The City establish priorities for the improvement of freeways and encourage acceptance of such priorities by the state.
- The City's highway and freeway system to be improved as a major component of the City's integrated transportation system. Better use of the highways and freeways is to be achieved through advanced traffic control systems and exclusive lanes for buses and carpools.

HIGHWAYS

- Within the core of principal centers, pedestrian and non-pedestrian traffic be separated.
- Intersections of local streets with highways be spaced one-quarter mile or more apart where feasible.
- Vehicular access to properties abutting highways be restricted to adjacent local streets, service roads or alleys, where feasible.

AUXILIARY TRANSIT

- Auxiliary transit systems, compatible with the primary system, be developed on unobstructed rights-of-way within the principal centers. Where there is sufficient demand, the auxiliary systems should be built before the primary system; otherwise, the two systems should be built simultaneously.
- Feeder bus lines connecting suburban areas with public rapid transit stations be developed concurrently with the primary system.
- The City should encourage bus service within a reasonable walking distance of residences, generally located on major and secondary highways and focused on adjacent centers. Bus service may be reduced where an auxiliary transit system is built.

(2) FREEWAYS AND HIGHWAYS. In the past, emphasis in transportation planning in Los Angeles has been upon the freeway and highway system. While this vehicular system is clearly recognized as a vital component of the City's circulation system, it will not be able to singularly accommodate future traffic demands. Many of the major problems of the greater Los Angeles area have been developed, directly or indirectly, as a result of the tremendous individual use of the automobile. While bus transportation, carpooling, park-and-ride systems, among others, offer added dimensional and viable alternatives, some form of mass rapid transit is needed.

The planned freeway and expressway system for the Los Angeles region is shown in Figure II-130. The proposed network is essentially a grid

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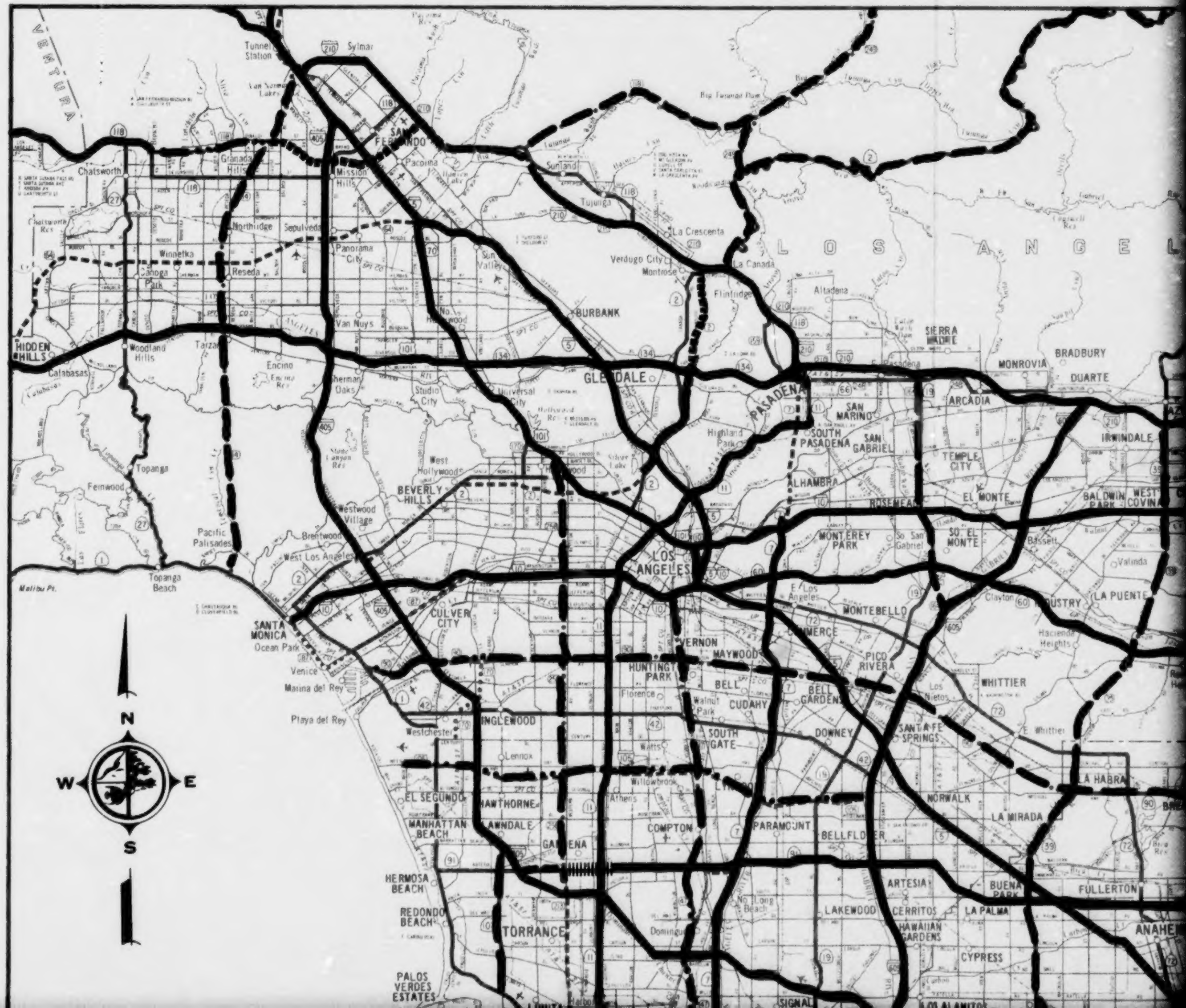
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Sylmar
Van Norman Lakes
SAN FERNANDO
Pacoima
Chatsworth
Granada Hills
Mission Hills
Northridge
Sepulveda
Panorama City
Winnetka
Canoga Park
Reseda
Van Nuys
Sun Valley
No. Hollywood
BURBANK
Sunland
Tujunga
La Crescenta
Verdugo City
Montrose
La Canada
Flintridge
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Big Tujunga Dam
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MONROVIA
BRADBURY
DUARTE
HIDDEN HILLS
Calabasas
Woodland Hills
Tarzana
Encino
Encino Res
Sherman Oaks
Studio City
Universal City
GLENDALE
PASADENA
ARCADIA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
IRWINDALE
Highland Park
Topanga
Fernwood
West Hollywood
BEVERLY HILLS
Hollywood
Silver Lake
ALHAMBRA
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
Westwood Village
Brentwood
Pacific Palisades
West Los Angeles
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So. San Gabriel
SO. EL MONTE
Bassett
Valinda
Malibu Pt.
Topanga Beach
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
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E. Los Angeles
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Clayton
INDUSTRY
LA PUENTE
Hacienda Heights
VERNON
MAYWOOD
COMMERCE
PICO RIVERA
HUNTINGTON PARK
BELL
BELL GARDENS
Los Nietos
WHITTIER
Florence
Walnut Park
CUDAHY
INGLEWOOD
Westchester
Lennox
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
E. Whittier
Watts
Willowbrook
LA HABRA
EL SEGUNDO
HAWTHORNE
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FULLERTON
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L O S   A N G E L E S
SAN BERNARDINO
RIVERSIDE
Falling Springs
La Crescenta
La Canada
Flintridge
Altadena
SIERRA MADRE
BRADBURY
MONROVIA
DUARTE
PASADENA
ARCADIA
AZUSA
GLENDORA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
IRWINDALE
SAN DIMAS
LA VERNE
CLAREMONT
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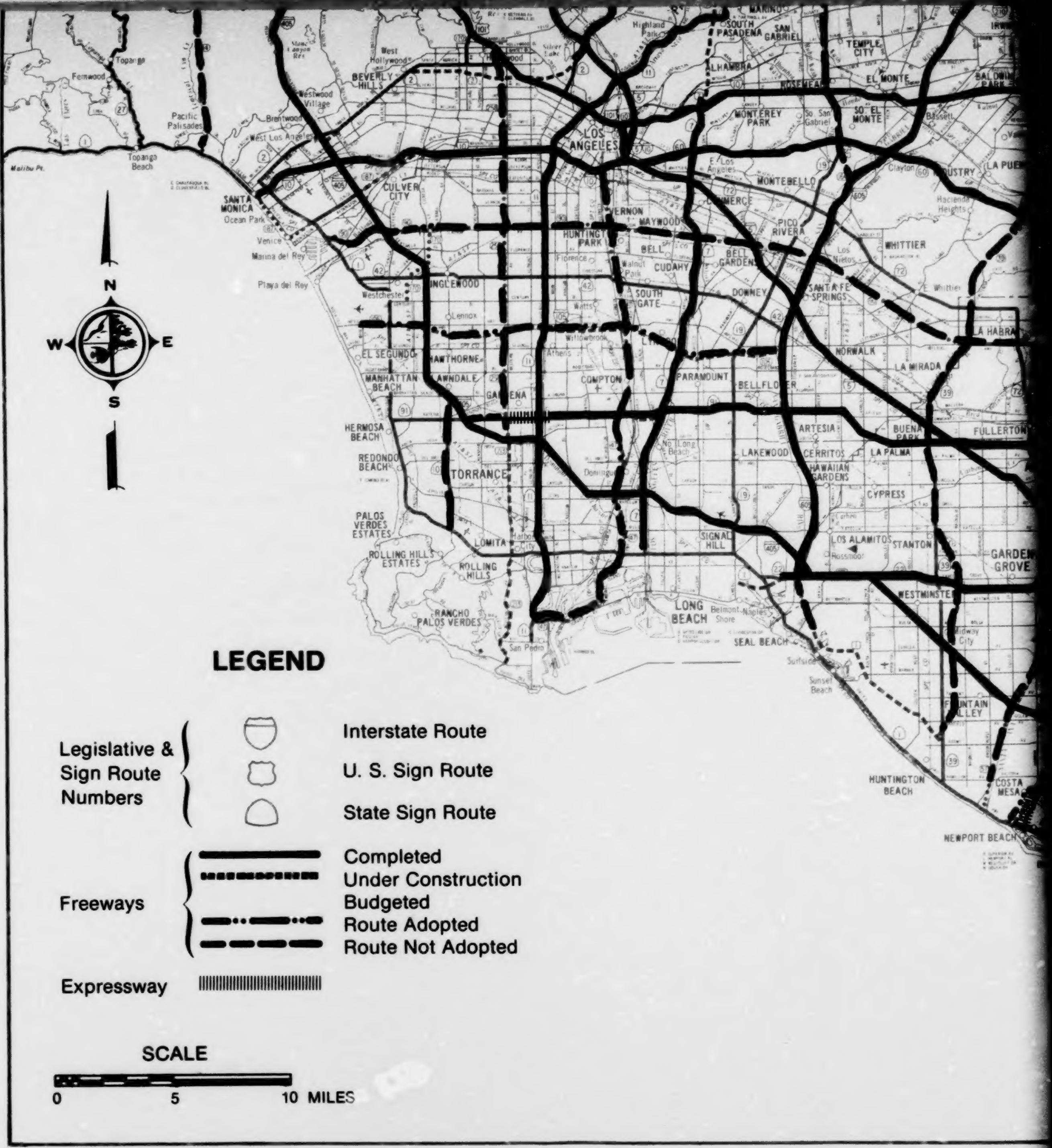
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FOUNTAIN VALLEY
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COSTA MESA
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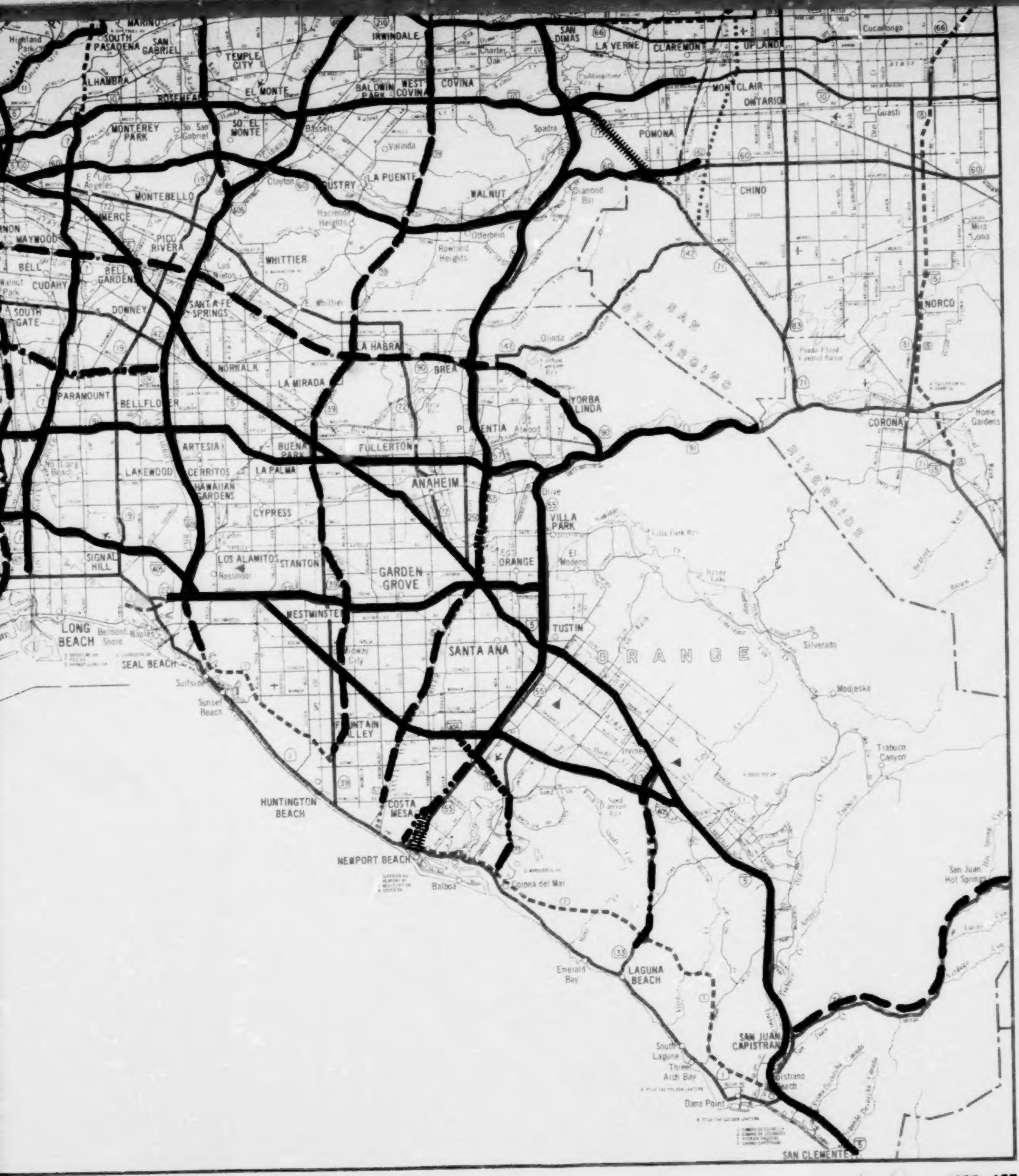
Pacific Palisades
Venice
Marina del Rey
San Pedro

Figure II-130. Planned freeway and expressway system for the Los Angeles region.

C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Rossmoor
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ORANGE
El Modeno
Villa Park Res.
Irvine Lake
LONG BEACH
Belmont Shore
Naples
SEAL BEACH
WESTMINSTER
TUSTIN
ORANGE
Silverado
SANTA ANA
Midway City
Surfside
Sunset Beach
Modjeska
FOUNTAIN VALLEY
Irvine
Trabuco Canyon
HUNTINGTON BEACH
COSTA MESA
NEWPORT BEACH
Balboa
Corona del Mar
San Juan Hot Springs
Emerald Bay
LAGUNA BEACH
South Laguna
Three Arch Bay
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Capistrano Beach
Dana Point
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system overlaying the older network that radiates out from Downtown Los Angeles. As the California Freeway System was conceived in 1958 in Senate Concurrent Resolution 26, it would serve every city of the state which will grow to 5,000 by 1980 - virtually every incorporated city. It would serve from one-half to three-fourths of all travel in the state and construction would be accomplished by 1980.

(a) Financial Issues. Recent events have reduced the freeway building program to operation and maintenance activities. The primary reasons are: decreased revenues, inflation, environmental review, and governmental review. Monies for highway construction come from three principle sources: (1) return from Washington of federal fuel taxes, (2) revenue from state fuel taxes, and (3) locally generated general tax funds. Total revenues are lower than anticipated levels due to decreased fuel consumption and pressures to use highway revenues to fund other programs.

Inflation has increased the cost of highway construction dramatically in the past few years. The California Construction index, set at 100 in 1967 and up to 150 by 1972, soared to 265 in 1974. In addition to increased material and labor costs the higher costs of the California Highway Patrol and Department of Motor Vehicles now use up virtually all of the vehicle registration and truck weight fees which have provided significant funds to the highway program in the past.

Additional costs have been incurred for environmental studies and for the implementation of environmental protection and enhancement measures. Finally, project review by numerous commissions, boards, and agencies can delay construction long enough that inflation erodes the highway budget.

Table II-65 shows the freeway system mileage for the Los Angeles area. About 50 percent of the planned system is complete for the three county area, while 60 percent of the planned mileage in the City of Los Angeles is complete. In light of the above discussion, major construction may be limited to closing important "missing links" unless new sources of revenue can be found.

(b) Operational Improvements. Programs to reduce delays, fuel consumption, and vehicle emissions have been planned for several existing Los Angeles freeways (see Figure II-131). Typically these projects involve modifying the freeway median to accommodate an extra lane for high occupancy vehicles and metering the on-ramps to keep the flow moving at high speeds. Projects like these are designed to optimize the existing street and freeway network with a relatively low investment. Tables II-66 and II-67 show ramp metering and preferential treatment implementation scheduling.

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Table II-65. Planned state highways in Los Angeles, Ventura, and Orange Counties (miles)(as of 1-1-76).

	LOS ANGELES CITY	LOS ANGELES COUNTY	ORANGE COUNTY	VENTURA COUNTY	TOTAL
Freeway Location Adopted	186.7	655.9	156.5	141.8	954.2
Total Freeways Planned	250.4	940.8	219.7	223.3	1383.8
Total Interstate System Planned	83.0	274.6	69.9	0.0	344.5
Freeway Open to Traffic	148.4	476.3	129.7	82.3	688.3
Percent of Planned Freeway Open	59.2	50.6	59.0	36.8	48.8

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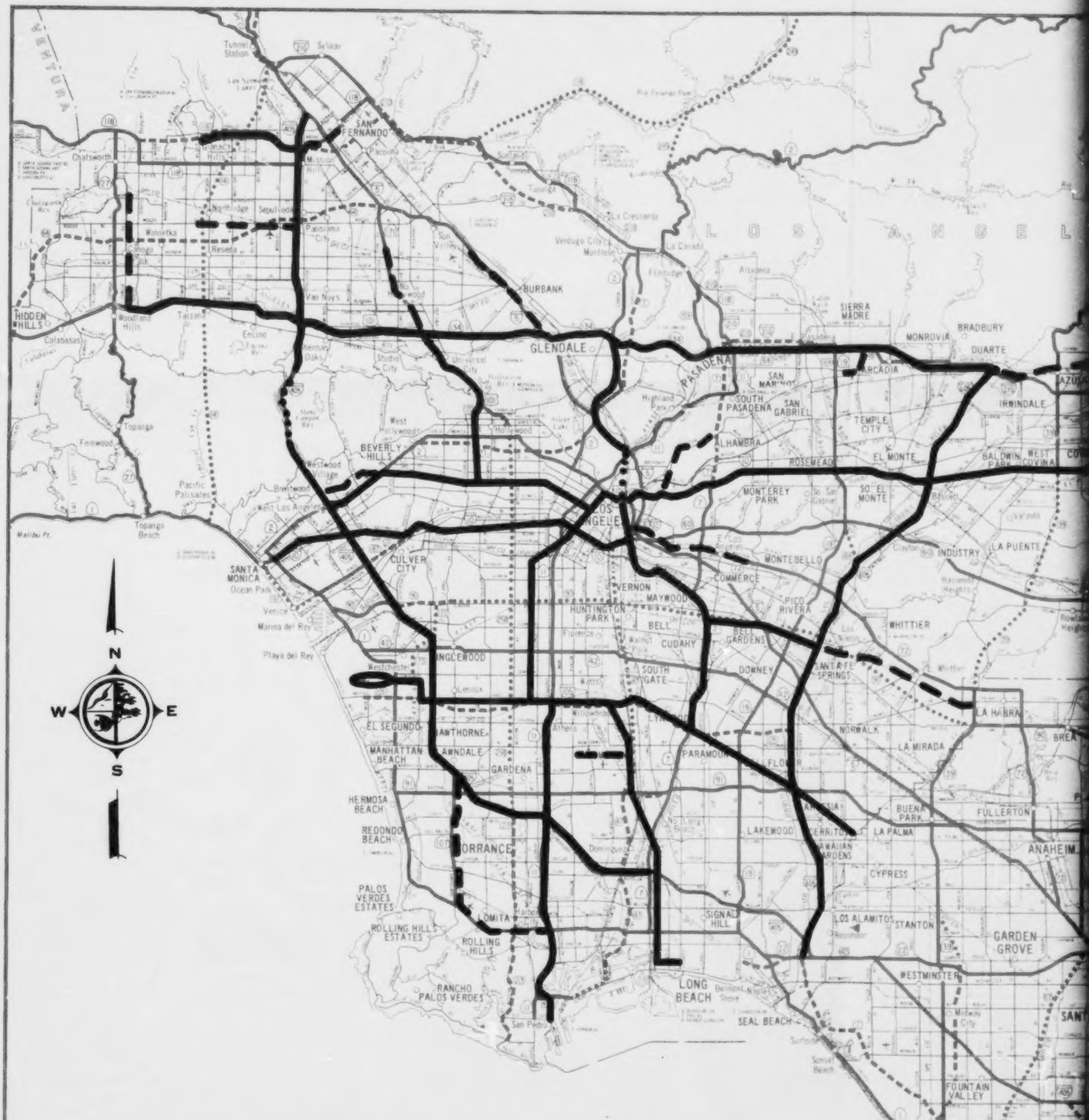
VENTURA
Tunnel Station
Sylmar
SAN FERNANDO
Chatsworth
Granada Hills
Mission Hills
Pacoima
Northridge
Sepulveda
Panorama City
Winnetka
Canoga Park
Reseda
Sun Valley
Tujunga
La Crescenta
Verdugo City
Montrose
La Cañada
Flintridge
Altadena
BURBANK
Van Nuys
HIDDEN HILLS
Woodland Hills
Tarzana
Encino
Calabasas
Sherman Oaks
Studio City
Universal City
GLENDALE
SIERRA MADRE
MONROVIA
BRADBURY
DUARTE
PASADENA
SAN MARINO
ARCADIA
AZUSA
IRWINDALE
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
Highland Park
West Hollywood
Hollywood
BEVERLY HILLS
Westwood Village
Topanga
Pacific Palisades
Brentwood
West Los Angeles
ALHAMBRA
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
MONTEREY PARK
SO. EL MONTE
LOS ANGELES
Malibu Pt.
Topanga Beach
SANTA MONICA
Ocean Park
CULVER CITY
MONTEBELLO
COMMERCE
INDUSTRY
LA PUENTE
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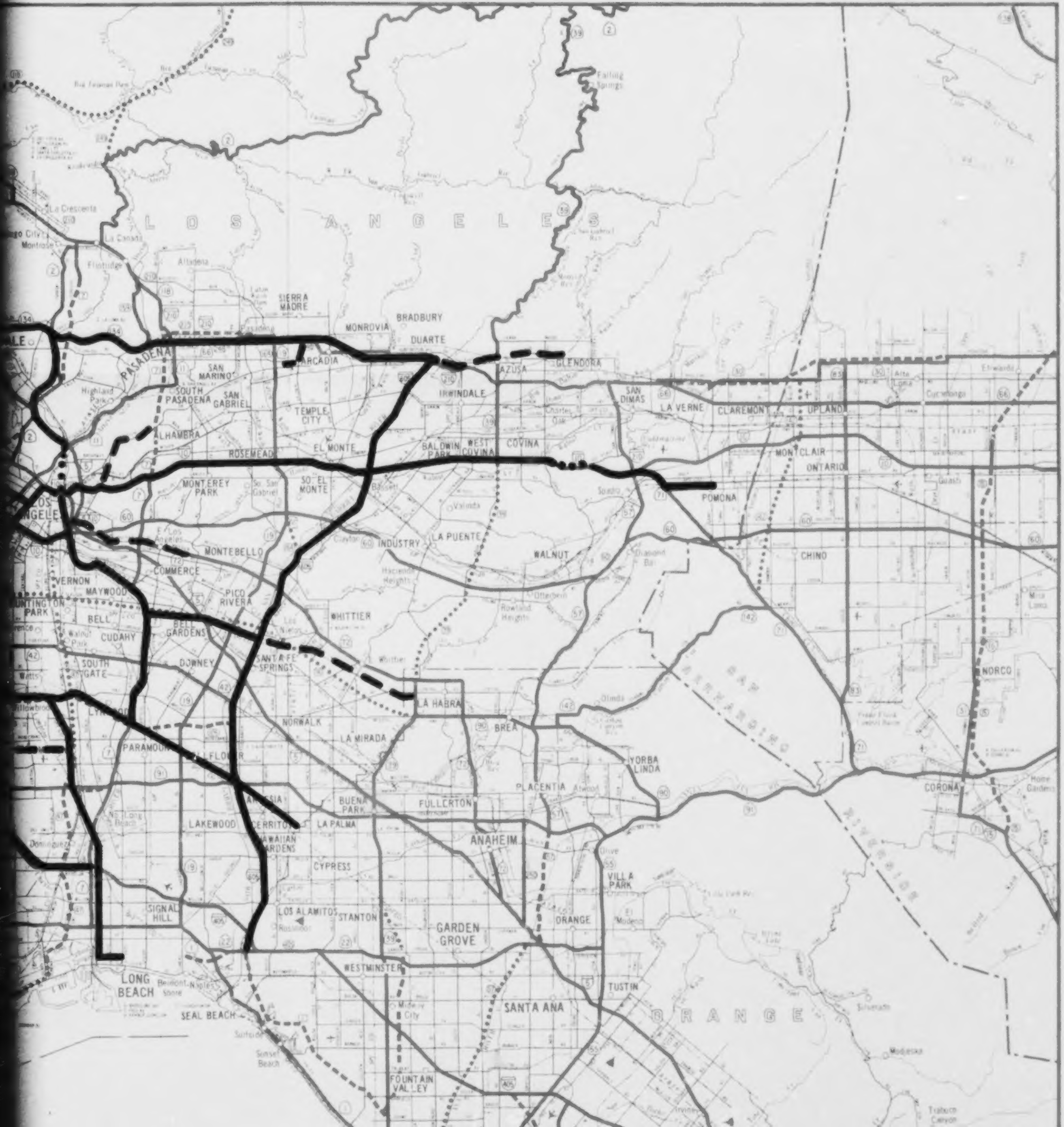

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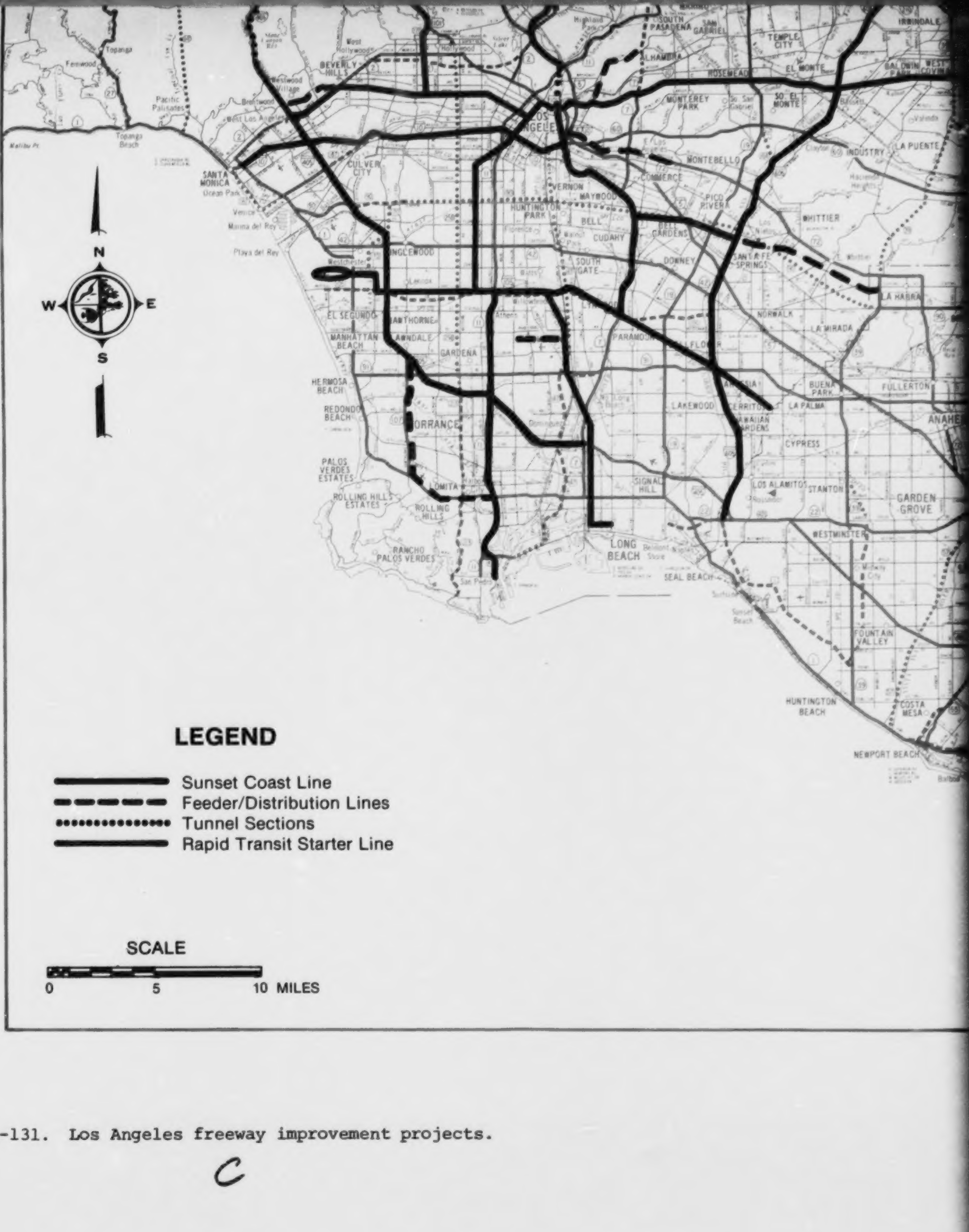
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Figure II-131. Los Angeles freeway improvement projects.

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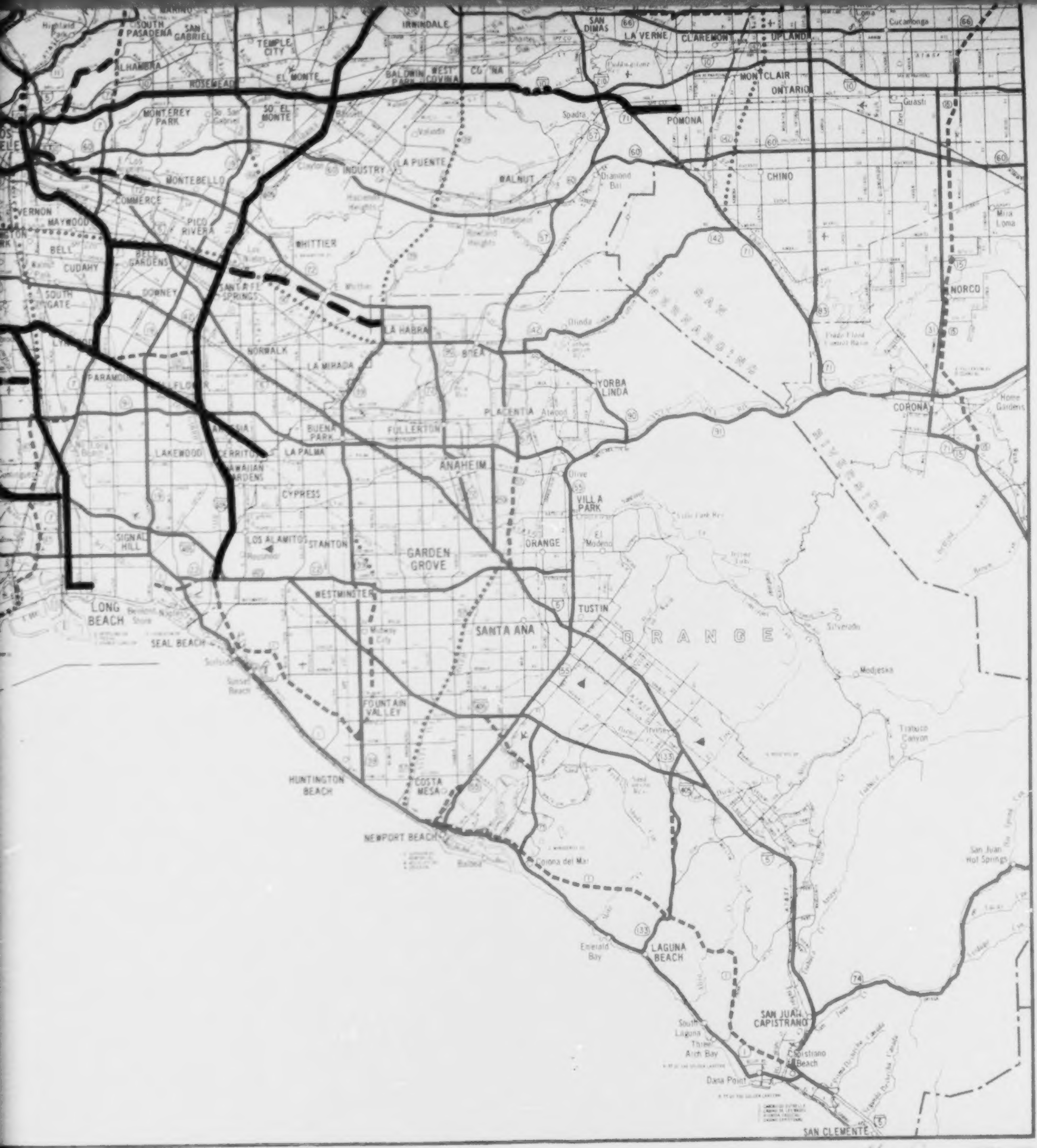
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Table II-66. Proposed ramp metering program (Southern California Association of Governments, 1975 Regional Transportation Plan, 1975).

	1974-1975		1975-1976		1976-1977		1977-1978		1978-1979	
ACTIONS	• Experiments and evaluation of San Diego Freeway bypass ramp meter completed. • Ramps identified for metering and bypasses. • Coordination with transit program completed. • 153 ramps controlled and • 14 bypasses operating.		• Continue implementing ramp metering program. • Emphasizes preferential bypass treatment for buses and carpools. • At year end, 178 ramps controlled and • 18 bypasses operating.		• Complete evaluation of program and make decisions to expand preferential. • Continue implementing ramp metering program. • At year end, 307 ramps controlled and • 72 bypasses operating.		• Continue implementing program throughout district 07. • At year end, 370 ramps controlled and • 95 bypasses operating.		• 523 ramps controlled and • 151 bypasses operating.	
	Ramp Meters	Bypasses	Ramp Meters	Bypasses	Ramp Meters	Bypasses	Ramp Meters	Bypasses	Ramp Meters	Bypasses
Santa Monica Fwy.	26	8	30	10	37	10	37	10	37	10
San Diego Fwy.	50	2	66	2	89	25	96	27	96	38
Harbor Fwy.	15	1	15	1	33	6	33	6	39	6
Hollywood Fwy.	6	1	6	1	18	3	30	7	30	7
Golden State Fwy.	22	2	22	3	50	17	50	17	54	17
Artesia Fwy.	0	0	0	0	0	0	0	0	57	27
Ventura Fwy.	10	0	10	0	10	0	10	0	10	0
Long Beach Fwy.	5	0	5	0	13	3	49	20	49	20
Pomona Fwy.	7	0	7	0	7	0	7	0	7	0
Santa Ana Fwy.	12	0	17	1	30	3	38	3	80	6
San Gabriel River Fwy.	0	0	0	0	15	3	15	3	59	18
Garden Grove Fwy.	0	0	0	0	5	2	5	2	5	2
ANNUAL COST	$18,027,000		$6,107,000		$25,483,000		$8,240,000		$8,860,000	
ACCUMULATED COST	$18,027,000		$24,134,000		$49,617,000		$57,857,000		$66,717,000	

*Approximately 25% of ramp meters will provide preferential treatment for bus and carpool.

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Table II-67. Preferential treatment on freeways for high occupancy vehicles (Southern California Association of Governments, 1975 Regional Transportation Plan, 1975).

	STAGE 1			
	1975-76	1976-77	1977-78	1979-80
PROJECTS	Santa Monica Freeway reserve existing lane $55,000 San Diego Freeway add median lane (portion) $2,700,000 Harbor Freeway ramp meter bypass $800,000	Long Beach Fwy. $5,000,000 Golden State Fwy. ramp meter bypass $1,600,000 Extension of project on San Diego Fwy. add median lane $8,200,000	Artesia Freeway add median lane $2,800,000 Extension of project on San Diego Fwy. add median lane $2,300,000	Extend preferential treatment to: • Ventura Freeway • Hollywood Freeway • San Bernardino Freeway (to vicinity of Ontario Airport) • Pomona Freeway • Newport Freeway • Riverside Freeway • San Diego Freeway (to Newport Freeway)
ANNUAL COST	$3,555,000	$14,800,000	$12,200,000	$12,200,000
ACCUMULATED COST	$3,555,000	$18,355,000	$35,655,000	$35,655,000

(3) MASS TRANSIT. To accomplish the goal of increasing bus ridership, transit districts plan to expand their bus fleet size about 20 percent (total) by 1980. Table II-68 shows the expected bus acquisition schedule. The combination of additional buses, a subsidized low fare, an expanded grid system network, preferential land treatment on freeways, and park-and-ride lots is expected to increase patronage considerably in the next few years.

Table II-68. Implementation of bus acquisition program: Los Angeles County (Southern California Association of Governments, 1974 Regional Transportation Plan, 1975).

1975-76		1976-77		1977-78		1978-79		1979-80	
BUSES	MINI-BUSES	BUSES	MINI-BUSES	BUSES	MINI-BUSES	BUSES	MINI-BUSES	BUSES	MINI-BUSES
TOTAL NUMBER OF BUSES PURCHASED									
691	73	496	13	296	17	344	21	388	12
NUMBER OF BUSES ADDED TO FLEET									
424	73	229	6	121	13	116	17	108	6
OPERATIONAL FLEET SIZE									
3025		3260		3394		3527		3641	

(a) Rail Mass Transit. Clustering of development is closely tied to encouraging support for mass transit. Increased density and the City Centers Concept provides a faster, more convenient system. Generally, the highest trip generating activities should be located closest to mass rapid transit (MRT) facilities to provide for direct pedestrian access and to eliminate the need to use motor vehicles. Land uses within the corridors require levels of accessibility compatible with the levels of accessibility provided by the transportation facilities and must be of such intensity as to support but not hinder the efficient operation of these facilities.

There is a reciprocal relationship between mass transit and land use, typically, when MRT corridor proposals are implemented, a transitional period begins during which pressure builds for rezoning of individual land uses within corridors to reflect the level of accessibility provided by that corridor. When such pressure becomes sufficiently great, rezoning usually occurs. The effects of BART terminals in Contra Costa County present a classic example of this process. In such cases the new uses should be located as close as possible to the predominate type of transportation that each use requires. This transitional period may take as long as 20 to 40 years to complete in the absence of overall redevelopment plans.

Using these general concepts, the transportation system proposed by the City of Los Angeles integrates mass transit with the Centers Concept. The City's specific policies regarding rapid transit are set forth in its adopted *Citywide Plan* as well as in the Southern California Association of Government's *1975 Regional Transportation Plan: Towards a Balanced Transportation System:*

> The City, in coordination with the Southern California Rapid Transit District, seek federal, state, county, and private support for better public transportation.
>
> An immediate system of bus routes connecting centers, and providing access to centers from suburban areas be provided, parts of which may be replaced by the rapid transit system.
>
> The rapid transit system be in the form of a network connecting centers with other centers. It is to be operated on its own grade separated right-of-way, either above or below ground depending upon local conditions. "Park-and-ride" stations for the parking of automobiles, bicycles, and facilities for transfer between local and rapid transit.
>
> The type of rapid transit facility selected be that which most closely meets the criteria set forth in the Public Transportation Element of the General Plan.
>
> The phasing of the rapid transit system be based upon priorities derived from transportation needs and centers development.
>
> Rapid transit stations within centers be developed as multifunction structures at the locations most suitable to serve intensive development.
>
> The rapid transit system and auxiliary transit system be utilized for the hauling of light freight.

The regional mass transit system advocated by the City of Los Angeles is the high density rapid transit line endorsed by the City's *ad hoc* Technical Committee - the route traveling from the San Fernando Valley, through the Wilshire area to Downtown and into South Central Los Angeles (Figure II-132). As additional funds become available, the City recommends extension of the system to the San Pedro-Long Beach Harbor area (Bradley, 1975).

The proposed system's characteristics include (Bradley, 1975):

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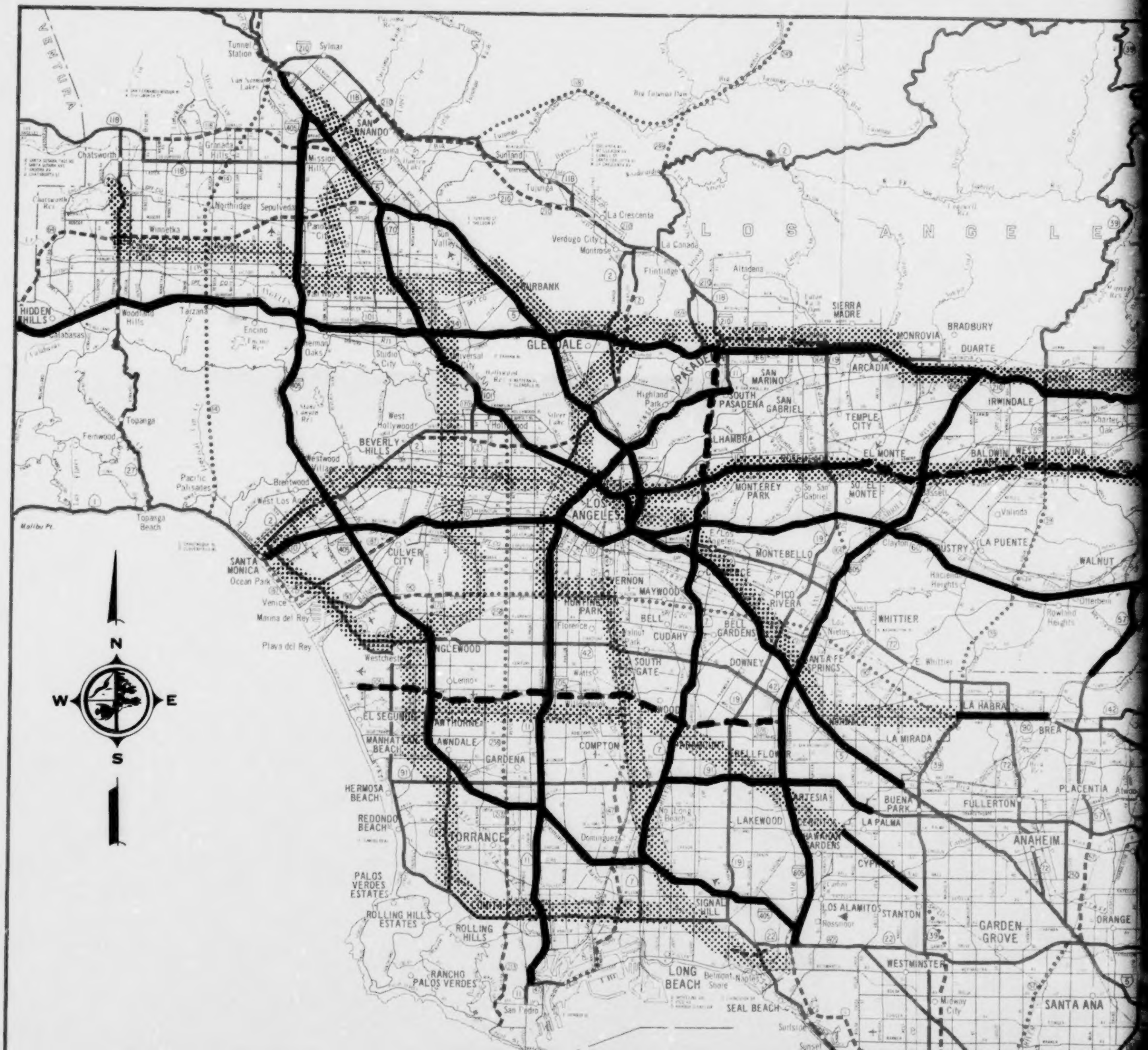
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La Crescenta
Verdugo City
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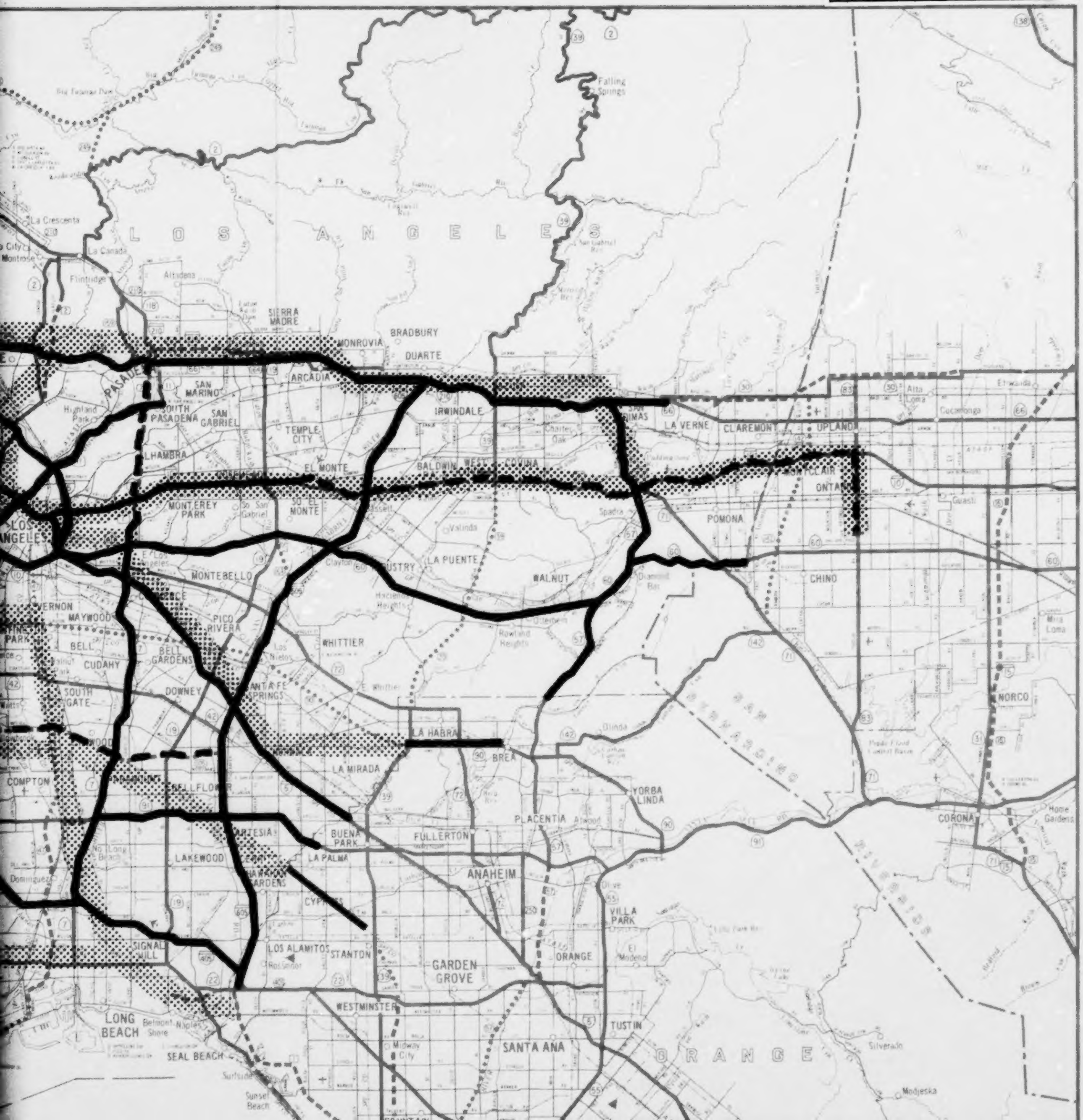
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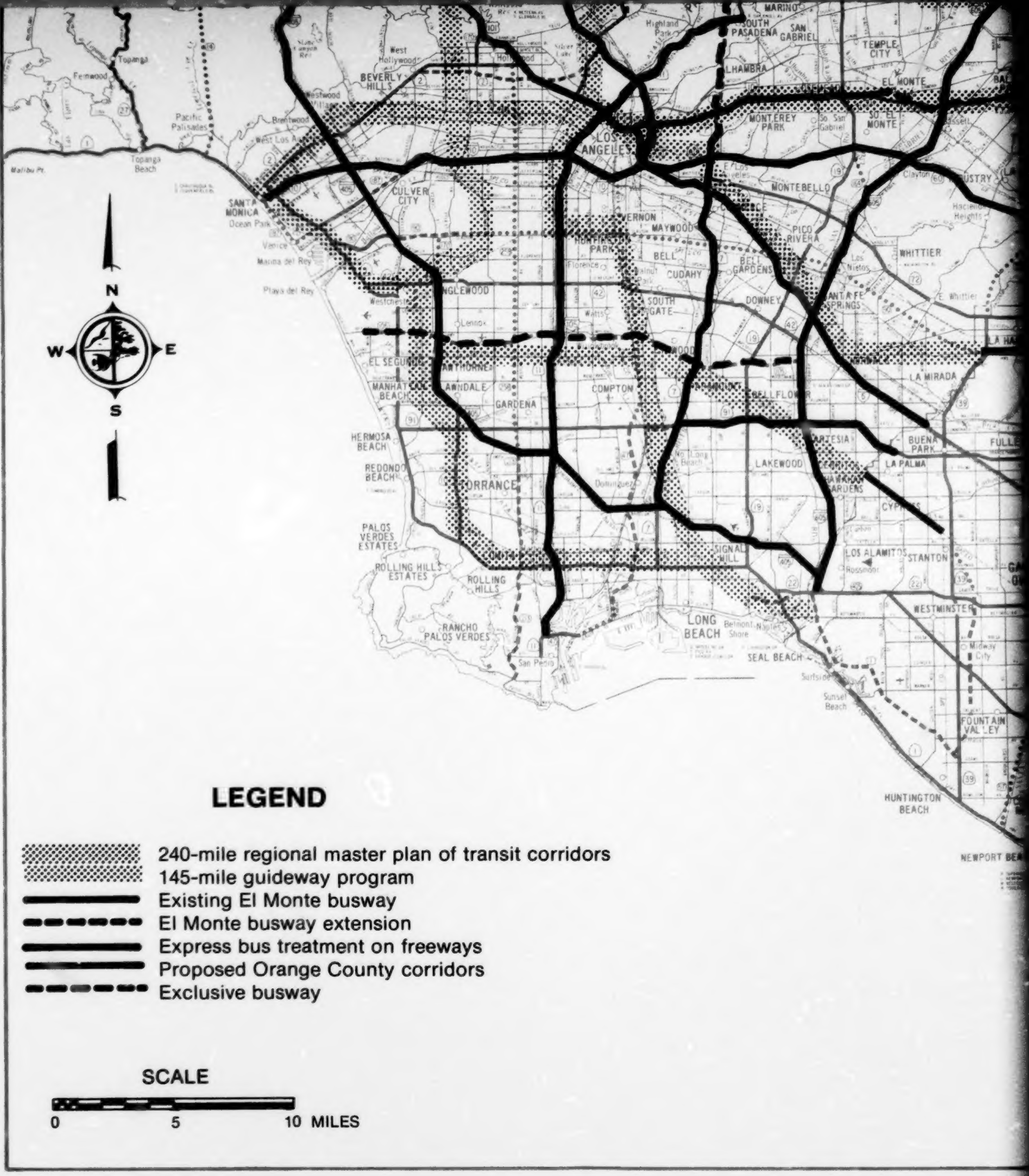
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Figure II-132. Proposed regional mass transit system.

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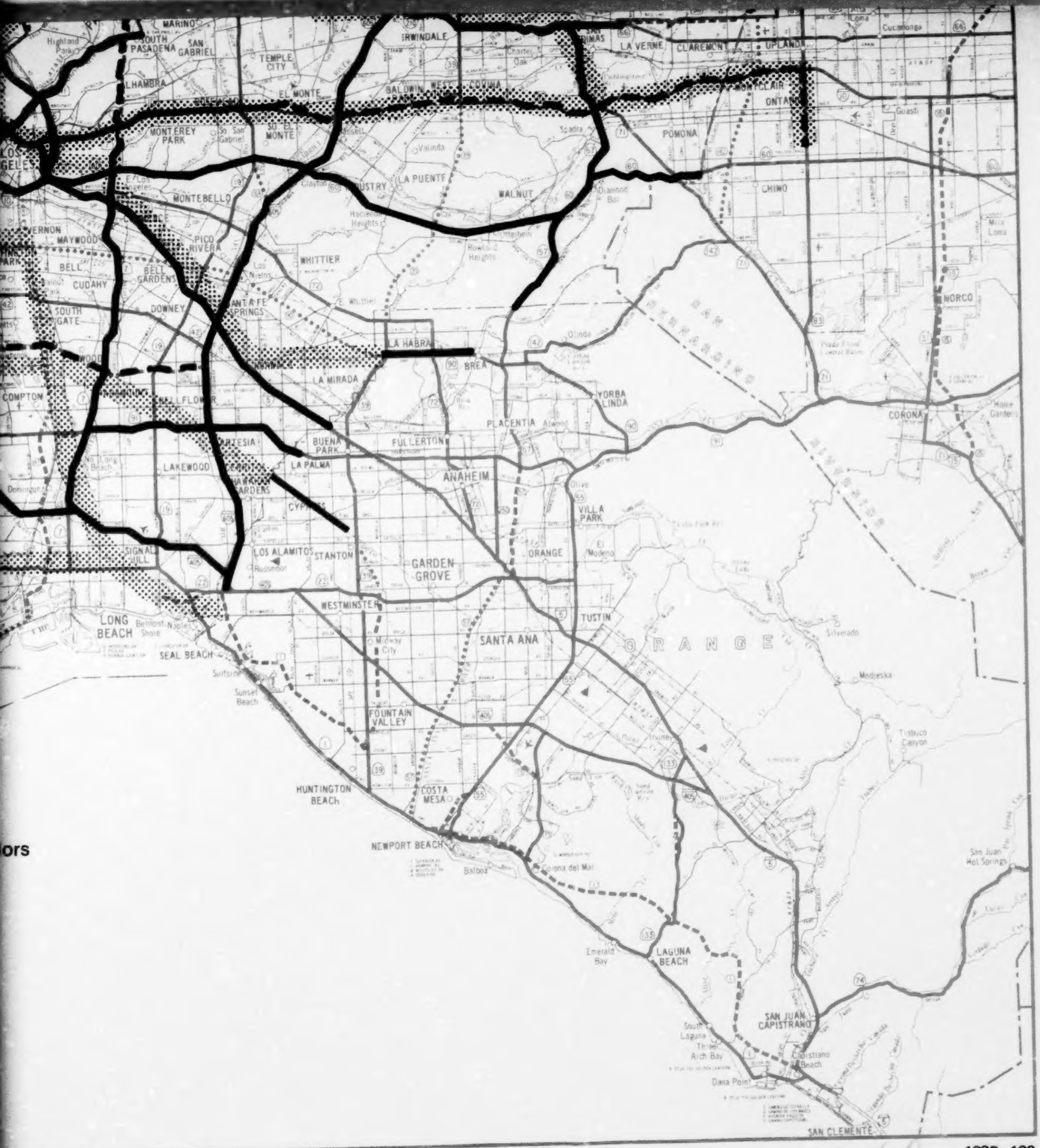

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South Laguna
Three Arch Bay
Capistrano Beach
Dana Point
SAN CLEMENTE

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- The proposed high density line would make use of a technically advanced medium capacity vehicle which could travel at 75 mph,
- It will provide transportation between places of residence and places of employment - more than 50 percent of the San Fernando Valley commuters work along the Wilshire corridor between Century City and Downtown, within easy access of the proposed line,
- The high density line would serve an average of 21,200 jobs per mile,
- Preliminary ridership estimates for the City's high density line predict 185,000 daily trips for the 24-mile system,
- A cost review by the Southern California Association of Governments (SCAG) indicates that construction of this system will exceed $1 billion.

(b) Starter Line. The Rapid Transit Advisory Committee (RTAC) was established in March 1975 to analyze data developed by previous studies for the corridors of the adopted Transit Master Plan and make recommendations as to the corridors best suited for a fixed guideway starter line project.

In three months, the RTAC was able to narrow the field of alternatives to three primary corridor alternatives. All three connect the San Fernando Valley, the Los Angeles/Central Business District (CBD), and the South Central portion of the County.

At the completion of the first phase of the Rapid Transit Advisory Committee work, the generalized corridor shown in Figure II-133 has been endorsed by the Southern California Rapid Transit District Board of Directors, the City of Los Angeles, and the County of Los Angeles.

On 21 November 1975, public officials agreed on a portion of the proposed 69-mile network. The first leg would run 25.7 miles from Union Station in Downtown Los Angeles to the City of Long Beach. The estimated cost would be $911 million and would carry 139,000 passengers per day by 1990. This proposal is expected to provide the basis for a grant application for federal funds to the Urban Mass Transportation Administration (*Los Angeles Times*, 23 November 1975).

This opportunity to reduce VMT would depend on modifying the behavior of commuters and shoppers concerning the use of public transit systems. The American dependence on automobiles results from a complex interaction of social and economic factors, but the majority of the world's population uses public transportation system and accepts such systems as a way of life. Adequate and timely service can encourage Los Angeles County residents in general, and study area residents in particular, to use public systems.

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(c) The Sunset Coast Line. Los Angeles County voters were given their third chance in less than eight years to decide whether they wanted to build a rail mass transit system. The Southern California Rapid Transit District directors formally placed Los Angeles County Supervisor Baxter Ward's proposal for a $5.8 billion regional rapid transit system on the June 8 primary election ballot. The 232 mile system would have served 44 cities with lines built within freeway medians and shoulders, on existing railroads rights-of-way, and on flood control channel embankments. Had the ballot measure been approved, the system would be paid for by a one-cent sales tax increase. Figure II-133 shows the proposed Sunset Coast Line plus the starter line discussed earlier. However, the measure failed to pass.

Part of the problem of building a rail rapid transit system in Los Angeles is the staggering costs involved. Rail systems have become the costliest public works programs for a number of cities (see Table II-69). Los Angeles voters have been unwilling to approve tax increases to pay for a modern system. One reason for the high costs is that Los Angeles is a comparatively low density city (see Table II-70) so a system that will serve a large percentage of the population becomes very long.

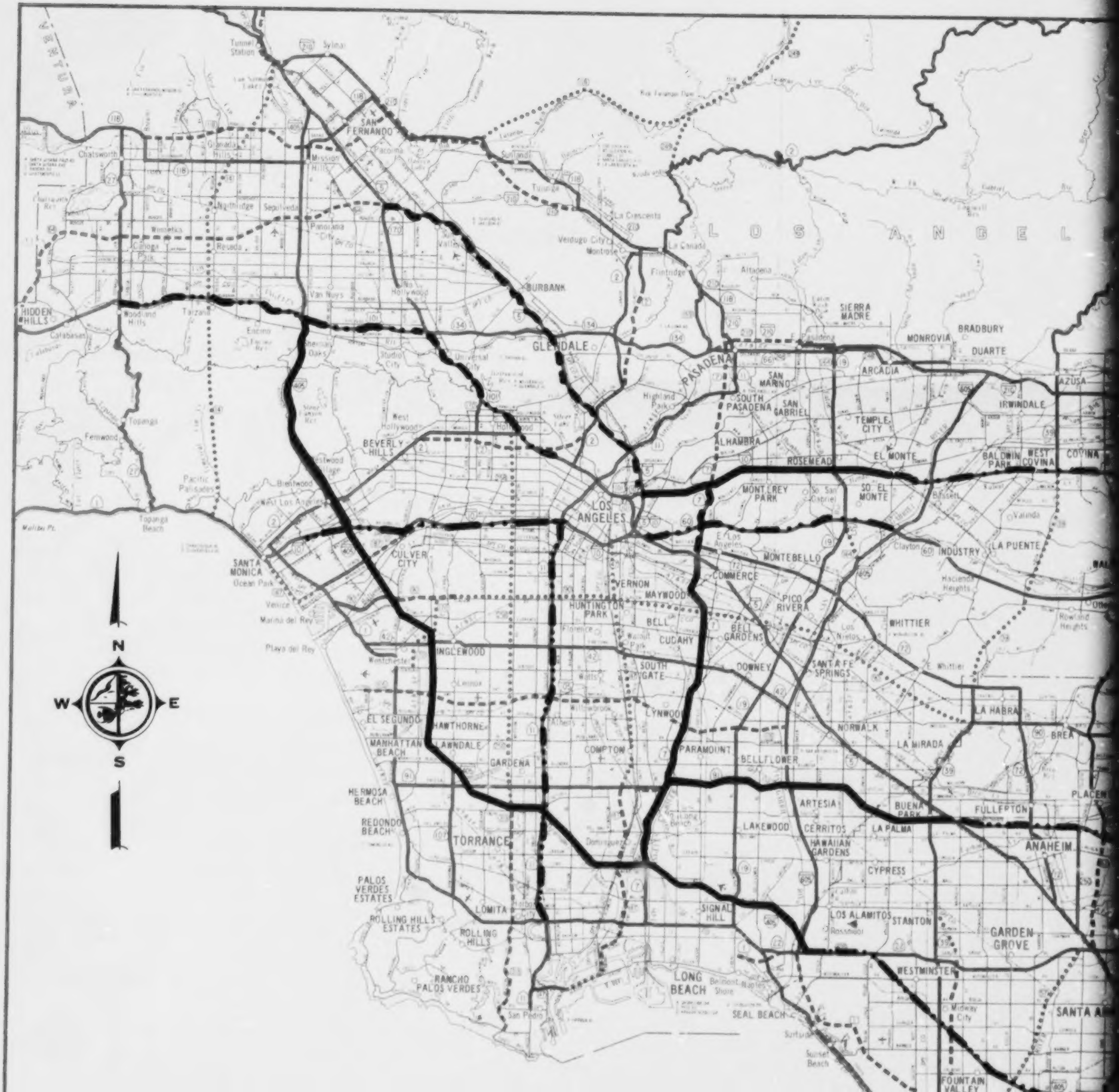
In November 1974, citizens of Los Angeles County considered a measure to increase the sales tax from 6 to 7 percent in order to finance the construction of a regional 145-mile fixed guideway rapid transit system. The sales tax measure had been recommended by consultants and subsequently adopted by RTD's Board of Directors as the only feasible financing mechanism available to construct and operate a complete regional transit system.

The previous passage of Proposition 5, the gas tax diversion referendum (June 1974), made substantial local funding available despite the failure of Proposition A. A reorientation of thinking did result as the "do it all at once" philosophy gave way to a more pragmatic, piecemeal concept. This building block approach to full system completion has been endorsed by the Urban Mass Transportation Administration as a proper method of implementation for regional fixed guideway transportation plans.

Conclusions of the special *Urban Mass Transit Administration (UTMA)* (March 1974) state that no single mode of transportation or one-dimensional program could satisfy the broad range of regional goals and objectives, but that a regional transit improvement program would have to integrate a mix of activities designed to accommodate the individual requirements of an area as diverse as Los Angeles. As a result, eight program elements were defined in the study conclusions:

- Schedule, service, and fare structure improvements to existing bus service.
- Expanded local bus grid coverage.

A


VENTURA
SAN FERNANDO
Chatsworth
Northridge
Sepulveda
Panorama City
Canoga Park
Reseda
Van Nuys
Burbank
Tujunga
La Crescenta
Montrose
Flintridge
La Canada
Altadena
LOS ANGEL
SIERRA MADRE
MONROVIA
BRADBURY
DUARTE
ARCADIA
AZUSA
IRWINDALE
HIDDEN HILLS
Woodland Hills
Tarzana
Encino
Calabasas
Sherman Oaks
Studio City
Universal City
GLENDALE
PASADENA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
TEMPLE CITY
ALHAMBRA
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
COVINA
Topanga
Fernwood
West Hollywood
Hollywood
BEVERLY HILLS
Brentwood
Pacific Palisades
West Los Angeles
LOS ANGELES
MONTEREY PARK
SO. EL MONTE
LA PUENTE
INDUSTRY
SANTA MONICA
Ocean Park
Venice
Marina del Rey
Playa del Rey
CULVER CITY
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
CUDAHY
COMMERCE
MONTEBELLO
PICO RIVERA
BELL GARDENS
WHITTIER
INGLEWOOD
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
LYNWOOD
EL SEGUNDO
HAWTHORNE
MANHATTAN BEACH
LAWNDALE
GARDENA
COMPTON
PARAMOUNT
BELLFLOWER
NORWALK
LA MIRADA
LA HABRA
BREA
HERMOSA BEACH
REDONDO BEACH
TORRANCE
LAKEWOOD
ARTESIA
CERRITOS
HAWAIIAN GARDENS
BUENA PARK
LA PALMA
FULLERTON
ANAHEIM
CYPRESS
PALOS VERDES ESTATES
ROLLING HILLS ESTATES
ROLLING HILLS
LOMITA
SIGNAL HILL
LOS ALAMITOS
STANTON
GARDEN GROVE
RANCHO PALOS VERDES
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SEAL BEACH
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FOUNTAIN VALLEY
Sunset Beach
Malibu Pt.
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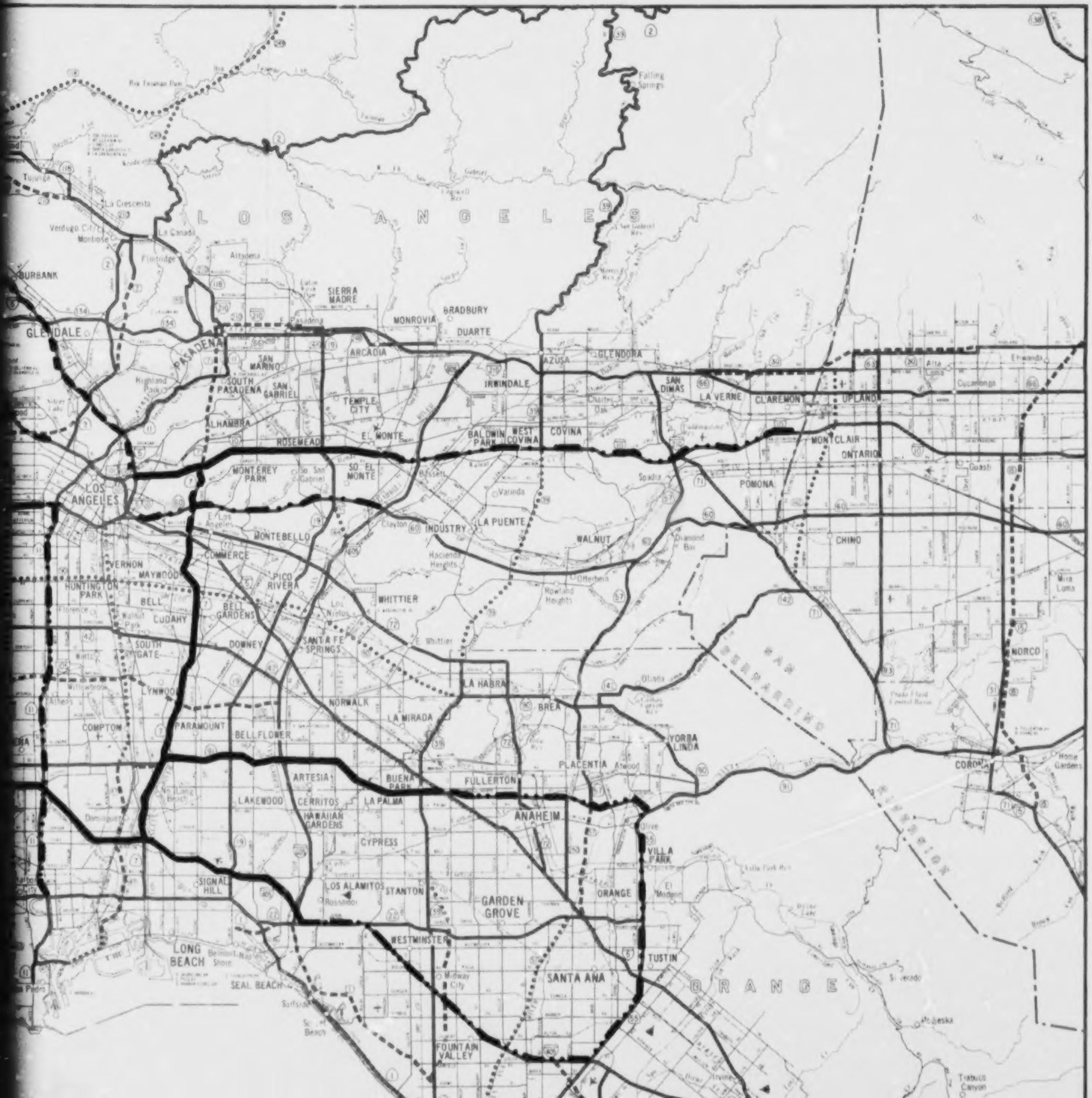

Falling Springs
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La Crescenta
Verdugo City
Montrose
La Canada
Flintridge
Altadena
BURBANK
GLENDALE
SIERRA MADRE
MONROVIA
BRADBURY
DUARTE
LOS ANGELES
PASADENA
SAN MARINO
SOUTH PASADENA
SAN GABRIEL
ARCADIA
TEMPLE CITY
AZUSA
GLENDORA
IRWINDALE
SAN DIMAS
LA VERNE
CLAREMONT
UPLAND
Alta Loma
Cucamonga
Etiwanda
Highland Park
ALHAMBRA
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
COVINA
Charter Oak
MONTCLAIR
ONTARIO
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MONTEREY PARK
So. San Gabriel
SO. EL MONTE
Bassett
Valinda
Spadra
POMONA
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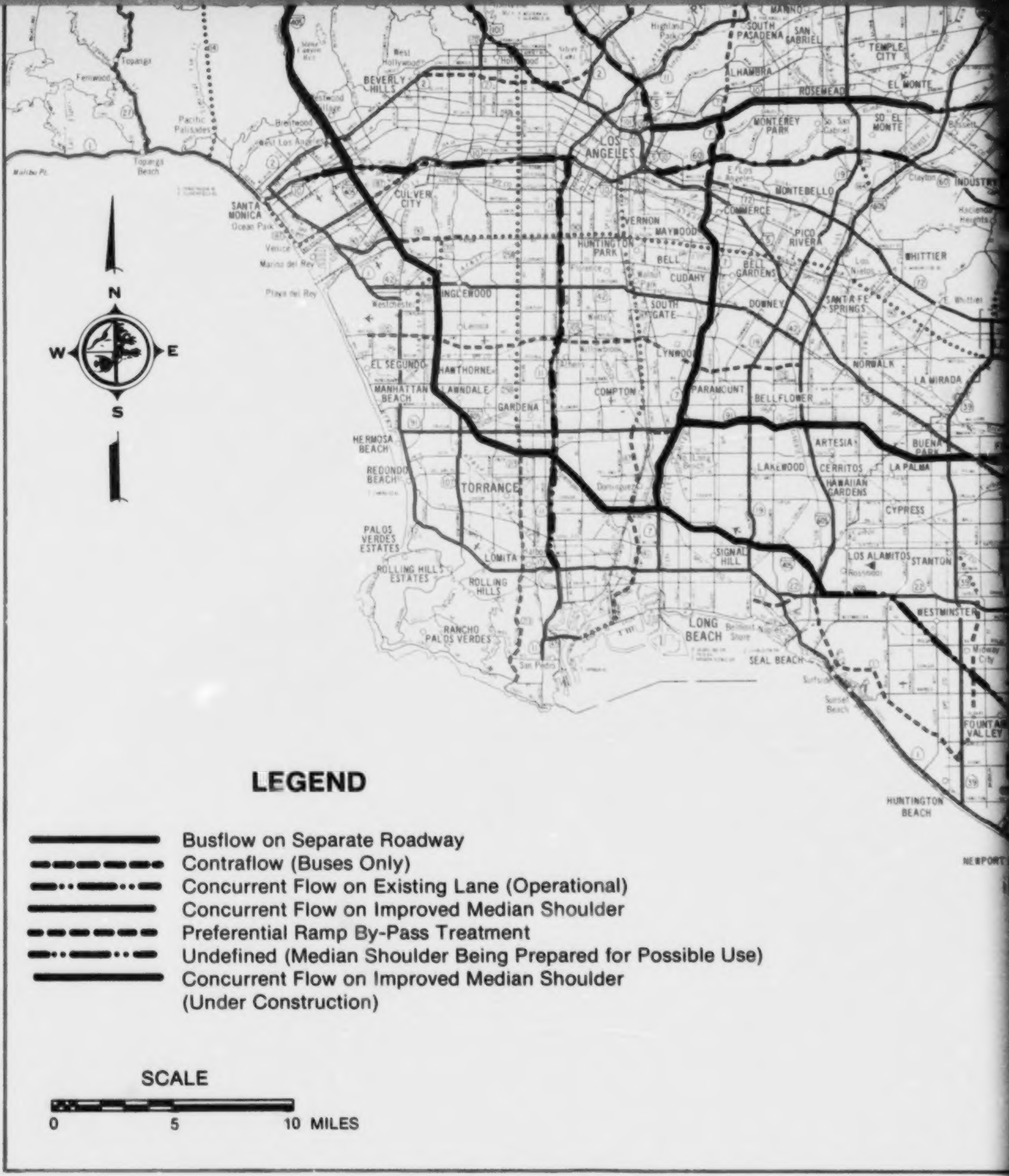
WALNUT
Diamond Bar
CHINO
Mira Loma
MONTEBELLO
COMMERCE
VERNON
MAYWOOD
HUNTINGTON PARK
BELL
Florence
Walnut Park
CUDAHY
BELL GARDENS
PICO RIVERA
Hacienda Heights
Los Nietos
WHITTIER
Rowland Heights
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
LYNWOOD
Athens
COMPTON
PARAMOUNT
BELLFLOWER
NORWALK
LA MIRADA
LA HABRA
BREA
Olinda
NORCO
SAN BERNARDINO
YORBA LINDA
PLACENTIA
Atwood
CORONA
Home Gardens
ARTESIA
BUENA PARK
FULLERTON
LAKEWOOD
CERRITOS
LA PALMA
HAWAIIAN GARDENS
ANAHEIM
Dominguez
CYPRESS
Olive
VILLA PARK
SIGNAL HILL
LOS ALAMITOS
Rossmoor
STANTON
GARDEN GROVE
ORANGE
El Modena
RIVERSIDE
LONG BEACH
Belmont Shore
WESTMINSTER
TUSTIN
SEAL BEACH
Surfside
Sunset Beach
Midway City
SANTA ANA
ORANGE
Silverado
Modjeska
FOUNTAIN VALLEY
Irvine
Trabuco Canyon
San Pedro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LEGEND
Busflow on Separate Roadway
Contraflow (Buses Only)
Concurrent Flow on Existing Lane (Operational)
Concurrent Flow on Improved Median Shoulder
Preferential Ramp By-Pass Treatment
Undefined (Median Shoulder Being Prepared for Possible Use)
Concurrent Flow on Improved Median Shoulder (Under Construction)
SCALE
0
5
10 MILES
Topanga
Fernwood
Pacific Palisades
Malibu Pt.
Topanga Beach
Brentwood
West Los Angeles
West Hollywood
Beverly Hills
Hollywood
Highland Park
South Pasadena
San Gabriel
Temple City
El Monte
Alhambra
Rosemead
Monterey Park
So. El Monte
Los Angeles
Santa Monica
Ocean Park
Venice
Marina del Rey
Playa del Rey
Culver City
Vernon
Maywood
Commerce
Montebello
Pico Rivera
Industry
Hacienda Heights
Whittier
Huntington Park
Bell
Cudahy
Bell Gardens
South Gate
Downey
Santa Fe Springs
Los Nietos
Westchester
Inglewood
Lennox
El Segundo
Hawthorne
Lynwood
Norwalk
La Mirada
Manhattan Beach
Lawndale
Gardena
Compton
Paramount
Bellflower
Hermosa Beach
Redondo Beach
Torrance
Artesia
Lakewood
Cerritos
Hawaiian Gardens
La Palma
Buena Park
Cypress
Palos Verdes Estates
Rolling Hills Estates
Lomita
Rolling Hills
Signal Hill
Los Alamitos
Stanton
Rancho Palos Verdes
San Pedro
Long Beach
Seal Beach
Westminster
Midway City
Surfside
Sunset Beach
Fountain Valley
Huntington Beach
Newport

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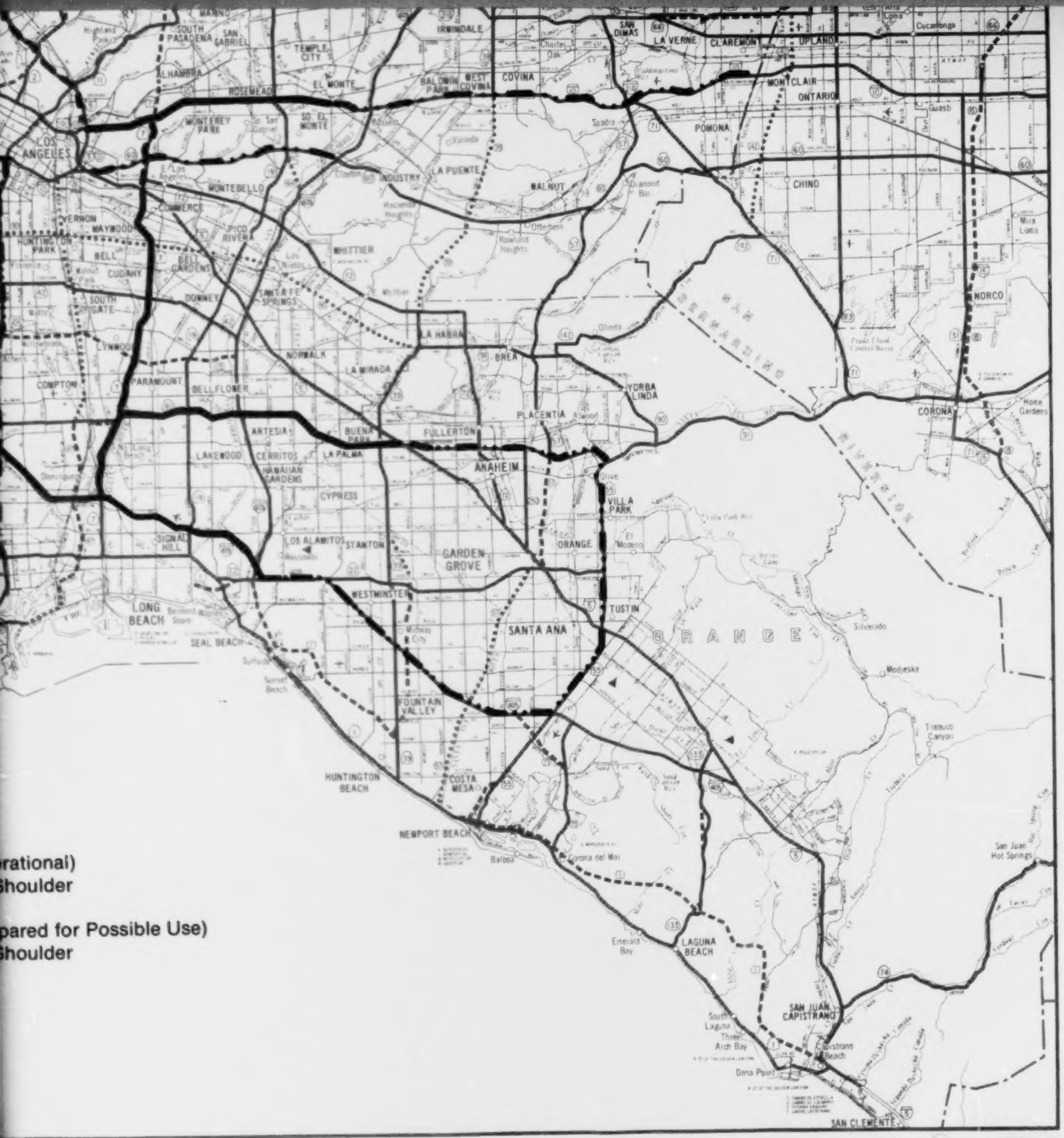
Figure II-133. Rapid transit starter line and other system elements.

rational)
Shoulder
pared for Possible Use)
Shoulder
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SAN GABRIEL
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SAN DIMAS
LA VERNE
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UPLAND
Cucamonga
ALHAMBRA
ROSEMEAD
EL MONTE
BALDWIN PARK
WEST COVINA
COVINA
MONTCLAIR
ONTARIO
Guasti
LOS ANGELES
MONTEREY PARK
SO. EL MONTE
POMONA
Spadra
INDUSTRY
LA PUENTE
WALNUT
Diamond Bar
CHINO
MONTEBELLO
COMMERCE
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PICO RIVERA
HUNTINGTON PARK
BELL
CUDAHY
BELL GARDENS
WHITTIER
Rowland Heights
Hacienda Heights
Mira Loma
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
LYNWOOD
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LA MIRADA
LA HABRA
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SAN BERNARDINO
YORBA LINDA
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CERRITOS
LA PALMA
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ANAHEIM
RIVERSIDE
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LOS ALAMITOS
STANTON
GARDEN GROVE
ORANGE
El Modena
LONG BEACH
SEAL BEACH
WESTMINSTER
TUSTIN
ORANGE
Silverado
SANTA ANA
Midway City
Modjeska
Sunset Beach
FOUNTAIN VALLEY
Irvine
Trabuco Canyon
HUNTINGTON BEACH
COSTA MESA
NEWPORT BEACH
Balboa
Corona del Mar
San Juan Hot Springs
Emerald Bay
LAGUNA BEACH
SAN JUAN CAPISTRANO
South Laguna
Three Arch Bay
Capistrano Beach
Dana Point
SAN CLEMENTE

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Table II-69. Modern rail rapid transit systems (Reasons, 1976).

SYSTEM	LENGTH (MILES)	COST $ BILLIONS	POTENTIAL RIDERSHIP OR VMT REDUCTION	COMMENT
SCRTD 1968	89	--	--	failed to pass
SCRTD RAIL-BUS 1974	145	10.0	7% reduction	failed to pass
SUNSET COAST 1976	232	5.8	1 million passengers per day maximum capacity	failed to pass
STARTER LINE	25	0.8	13,900 passengers per day	--
BART	71	1.6	2% daily - 4-6% during peak hour on Bay Bridge 125,000 passengers per day	64% cost over-run
METRO-WASHINGTON, D.C.	98 (4.2 open)	4.6	--	1968 est. $2.5 billion dollars
MARTA - ATLANTA	7.1	--	--	--

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- Dial-a-ride and other special community-responsive transit.
- Major activity center (e.g., minibus, PRT) transit.
- Bus-on-freeway and expansion of busway facilities both with park/ride.
- Bus on arterial improvements with park/ride.
- Regional fixed guideway system.
- Other specialized projects such as demonstration of computer rail services.

Table II-70. Population density in cities that have rail transit (Hebert, 1976).

CITY	DENSITY PEOPLE/MI^2
New York City	26,000
Manhattan	68,000
San Francisco	18,000
Washington, D.C.	12,000
Los Angeles	6,000

6. HOUSING

The housing component of the Los Angeles environment is imbued with both stock and flow dimensions. At any moment in time, the stock of housing can be represented by an inventory of habitable units. These units can be characterized by various measures such as floor space, number of rooms, type of plumbing and other accoutrements. But at the same time, this capital stock yields a flow of services to the consumer that is highly subjective in nature and these services have quantity and quality attributes. Factors such as environmental quality, accessibility, and various site characteristics all contribute to the "well being" of the inhabitants of any particular dwelling. In well functioning markets, all of these attributes are aggregated into the price or rental value of the dwelling unit.

The dynamics of an area's housing market are related to the forces of supply and demand and the way in which these forces interact to alter the size and composition of the area's housing stock. The demand factors that affect the housing market are economic and demographic. Population growth as influenced by natural increase and migration will influence the demand for housing. This influence will be modified by population characteristics such as age distribution and average family size.

The mechanism by which demographic pressure is transformed into housing market demands is economic. Area employment, real income and the relative prices of different types of dwellings as well as all other commodities will condition the demand side of the housing market. Given the competitiveness of the supply side of the housing market, and the ease with which labor and capital can flow in or out of housing, it will not be a significant violation of reality to treat the short-term characteristics of the housing market as largely demand determined. Besides, it is beyond the scope of this document to perform a complete exegesis of the area's housing market. However, this section does cast light upon the salient characteristics of the area's housing market and provide information useful for projection into the future.

It may also be possible to draw inferences about the level of "well being" of the area's inhabitants from changes in the size and composition of the housing stock. For example, if one accepts a particular characterization of the American Dream that includes single family detached dwellings, then a trend toward multiple family dwellings could be cautiously interpreted as signifying a decline in some index of "well being". This interpretation views increased residential density as something to be avoided. Certainly, the post World War II flight to the suburban fringes of our major cities indicates that space is a normal economic good. That is to say, consumers will buy more of it when its relative price declines or their real incomes increase. One final caveat is necessary before a consistent interpretation of the data is possible. It must be assumed that the values and preferences of the area's inhabitants are stable over the historical period, otherwise changes in housing consumption patterns cannot be interpreted as a consistent consumer reaction to changing prices and incomes.

Between 1940 and 1970, Los Angeles' stock of housing double (Community Analysis Bureau, 1975). Approximately one-half of the 1,077,000 residential units extant in 1970 was constructed during the 1940-1960 period. Much of this construction was detached single family dwellings. [Of the 1,148,077 units added to the housing stock of the County during this period, 888,591 or 77 percent were single units (Regional Planning Commission, 1 April 1976).] As a result of this housing boom, the number of owner-occupied homes rapidly increased. By 1960, 43 percent of the housing units in Los Angeles were owner-occupied.

In the 1960-1970 interval, residential construction fell in volume and changed in character. The increase in housing units (13 percent) was largely in multi-family dwelling units (Community Analysis Bureau, 1975). By 1970, 48 percent of the City's residential units were multi-family structures. During the same period, the proportion of owner-occupied homes dropped to 41 percent of all occupied units.

The post war years of the 1940s were an important period for the construction of single family homes, and this creation of family oriented residential neighborhoods throughout most of the City continued into the early 1950s. The limited vacant space of the peripheral and hillside areas in Central, West and South Los Angeles communities was developed during this period. Since the late 1950s most of the residential construction in West Los Angeles and Central has been apartment units; this also represents the greater share of the City's new multiple units.

A large proportion of the single family housing construction in the City between 1940 and 1970 was in the San Fernando Valley, and growth in the Valley since 1950 has accounted for most of the City's new detached homes. This is particularly true of the 1960s, since the number of single family residences in both Central and West Los Angeles dropped considerably.

The decade of the 1960s marked a period of intensive apartment construction and signaled an end to expansion of the single family residential neighborhood. From a plateau of 46 percent in 1960, the percentage of owner-occupied units dropped to 40 percent in 1970. The large increases in apartments and in renters are due principally to the impact of the San Fernando Valley, where multiple family units almost tripled in number.

Table II-71 summarizes Countywide trends. For example, between 1960 and 1970, the total number of housing units increased by 431,995. Of these, 336,159 or 77.8 percent were multiple units. The trend towards multiple units increased during the 1970-1976 interval. It is estimated that 175,163 new housing units were added to the County's housing stock during this period. Multiple units accounted for 146,969 or 83.9 percent of the additional units.

Since multiple units as a proportion of the total housing stock have been on the increase, their share has risen from 24.3 percent to 36.7 percent of the housing stock.

Table II-71. Trends in housing composition in Los Angeles County.

HOUSING UNIT TYPES APRIL 1, 1940 TO JANUARY 1976			
YEAR	SINGLE UNITS*	MULTIPLE UNITS	TOTAL UNITS
January 1, 1976	1,720,621	996,145	2,716,766
Percent	63.3	36.7	100.0
April 1, 1970 (Census)	1,692,427	849,176	2,541,603
Percent	66.6	33.4	100.0
April 1, 1960	1,596,591	513,017	2,109,608
Percent	75.7	24.3	100.0
April 1, 1950	1,108,577	334,114	1,442,091
Percent	56.8	23.2	100.0
April 1, 1940	708,000	253,531	961,531
Percent	73.6	26.4	100.0

*Includes single units, duplex units and mobile homes.

SOURCES: U.S. Bureau of the Census, 1940 through 1970 Censuses of Housing (as revised). Department of Regional planning, 1976 estimate.

Table II-72 presents some data that may partially explain this shift. In the 1970-1976 period, the cost of single family detached dwellings rose 83.68 percent, whereas rents increased by "only" 29.6 percent. To the extent that increased housing prices are reflected in mortgage payments, these payments would have increased 2.83 times the increase in rental payments during this period. This relative increase in costs of home owning undoubtedly explains part of the shift to multiple family dwelling units which are predominantly rental units.

Table II-72. Trends in housing costs—Los Angeles area; relative price trends (1960 index = 100) (Residential Research Committee "Have Price Trends in Southern California . . .").

COST OF LIVING LOS ANGELES		RENTS LOS ANGELES		HOME PRICES LOS ANGELES	
1970	131.0	124.2		141	
1971	135.5	128.9		145	
1972	139.7	130.9	Δ20%	150	
1973	149.2	135.2		159	Δ47.5%
1974	165.8	142.4		178	
1975	182.1	149.7		208	
1976	192.4	161.0		259	

1970-76	Rents	Δ29.6%
	Cost of Living	Δ46.8%
	Home Prices	Δ83.68%

Clearly, the cost of purchasing a new single family detached dwelling has risen relative to everything else and this trend is accelerating. If housing costs were removed from the price index the rise in the cost of living would have been considerably moderated. One way to moderate the housing effect on living costs is to purchase less housing. The shift to multiple family units may represent that sort of choice.

Housing units are not homogenous in character and the shift from single family to multi-family units represents a quantitative and qualitative change. It is not unreasonable to assert that this compositional shift represents a general reduction in the yield of housing services per unit. During the 1940-1960 period when real incomes were unambiguously increasing and transportation costs per trip (measured by variable outlays and commuting time) were falling, the population expressed a preference for more space and single family dwelling units. In the absence of any evidence suggesting a dramatic change in preferences, the current trends indicate a rational response to increases in the real cost of housing.

Parenthetically, the supply side of the market place acts as if land and capital (vertical structure) are close substitutes. Therefore, as land prices rise relative to other imputs, density of use increases for residential and nonresidential uses. Table II-73 reveals that residential land use density has increased in Los Angeles and most of the contract cities.

Table II-73. Residential land densities—Los Angeles and contract communities (Density Index).*

CITY	1970	1976	% D 1970-76
Los Angeles	5.034	5.302	5.32
Beverly Hills	6.672	6.814	2.21
Burbank	9.957	10.158	2.02
Culver City	10.133	12.761	25.93
El Segundo	10.839	11,131	3.82
Glendale	3.79	3.997	5.46
San Fernando	7.096	7.051	-.06
Santa Monica	15.51	17.097	10.23

*These densities are based on total housing units divided into acreage zoned for single and multiple residential use.

Table II-74 delineates by urban area the change in composition of the region's housing stock. Every community shows a relative and absolute increase in the number of multi-family dwelling units. In every community the number of single family dwelling units declined. Table II-74 is clearly the complement of Table II-73 and reflects the roles that changing land values and economic pressure ply upon the urban landscape.

Table II-74. Housing stock, Los Angeles City, contract communities (Source: Department of Regional Planning, County of Los Angeles, *Quarterly Bulletin*, No. 132, April 1, 1976.

YEAR	LOS ANGELES CITY			BURBANK			CULVER CITY			EL SEGUNDO		
	SF	MF	T	SF	MF	T	SF	MF	T	SF	MF	T
1970 (%)	618,936 (57.62)	455,237 (42.38)	1,074,173	23,736 (66.01)	12,227 (33.99)	35,963	7,932 (60.67)	5,143 (39.33)	13,075	3,841 (64.08)	2,153 (35.92)	5,994
1976 (Jan est.)	615,934 (54.44)	515,472 (45.56)	1,131,406	23,704 (64.61)	12,985 (35.39)	36,689	7,768 (47.19)	8,697 (52.81)	16,466	3,833 (62.28)	2,322 (37.72)	6,155
ΔT (%)			57,233 (5.33)			726 (2.0)			3,391 (25.93)			161 (3.5)
ΔMF. (%)	—	60,199 (13.23)	—	—	758 (6.19)	—	—	3,554 (61.10)	—	—	169 (0.78)	—
ΔS (%)	- 3,002 (-0.048)	—	—	- 32 (-0.013)	—	—	- 164 (-2.06)	—	—	- 8 (-0.02)	—	—
$\frac{\Delta MF}{\Delta T}$	—	1.052	—	—	1.044		—	1.048	—	—	1.049	—

YEAR	GLENDALE			SAN FERNANDO			SANTA MONICA			BEVERLY HILLS		
	SF	MF	T	SF	MF	T	SF	MF	T	SF	MF	T
1970 (%)	32,688 (57.91)	23,767 (42.09)	56,455	4,441 (79.89)	1,118 (20.11)	5,559	13,981 (33.21)	28,125 (66.79)	42,106	6,550 (43.41)	8,542 (56.59)	15,092
1976 (Jan est.)	31,722 (53.39)	27,696 (46.61)	59,418	4,403 (79.71)	1,121 (20.29)	5,524	13,653 (29.49)	32,655 (70.51)	46,308	6,506 (42.22)	8,906 (57.78)	15,412
ΔT (%)	—	—	2,963 (5.2)	—	—	- 35 (.06)	—	—	4,202 (9.97)	—	—	320 (2.12)
ΔMF (%)	—	3,929 (16.53)	—	—	3 (0.02)	—	—	4,530 (16.10)	—	—	364 (4.26)	—
ΔS (%)	-966 (-0.029)	—	—	-37 (-0.85)	—	—	- 328 (-2.34)	—	—	- 44 (-0.67)	—	—
$\frac{\Delta MF}{\Delta T}$	—	1.326	—	—	--	—	—	1.078	—	—	1.137	—

Undoubtedly, the energy crisis has reinforced the trends illustrated in data presented in this section. The doubling of gasoline prices since 1973, by increasing the variable costs associated with commuting, has enhanced the value of residential locations proximate to the place of work, or at least more central to habitual travel patterns.

Demographically, the trend toward reduced family size is a supportive element in the trend toward multi-family dwellings. Table II-75 reveals declines in almost every community. This reduction can clearly be translated as a reduced demand for space. Space is land and land is expense.

Table II-75. Trends in household size - average household size.

CITY	1940	1950	1960	1970
Los Angeles County	3.12	3.00	2.94	2.83
Beverly Hills	3.14	2.82	2.50	2.23
Burbank	3.20	3.15	2.90	2.56
Glendale	3.11	2.86	2.64	2.49
San Fernando	3.58	3.55	3.89	3.73
Santa Monica-Venice	3.04	2.96	2.67	2.33

Source: Regional Planning Commission - County of Los Angeles, "Quarterly Bulletin" No. 117, 2 July 1972.

Although demographic factors play an important role in the housing market, the period (1970-1976) appears to be dominated by economic considerations. Earlier it was noted that housing costs rose relative to all other costs in this interval. Table II-76 summarizes the salient information and re-emphasizes the role of economic factors. A modest inspection of this table reveals a host of factors encouraging the consumption of multi-family dwellings in lieu of the single family detached home.

Once all prices and incomes are deflated by the Consumer Price Index the real changes became apparent. It is clear that the 1970 to 1976 period was economically difficult for the Los Angeles region. Real incomes appear to have fallen substantially (about 12.2 percent overall). The numbers are rough estimates but they do indicate that money incomes rose faster than average rental prices and much slower than average housing prices. Thus, in real terms, the consumer could buy more housing services in rental housing (predominantly multi-unit housing) and less by purchasing single family dwellings. Columns 9 and 10 illustrate these relationships. Column 9 is the ratio of the change in money income to the change in average rent for the 1970 through 1975 period. For example, household money incomes in Burbank increased from $12,444 in 1970 to $16,990 in 1975. This change in income yields a ratio of 1.37 (column 3). During the same period average rents in the Los Angeles County area increased by 20 percent giving a ratio of 1.20 (column 8). The ratio of income change to rent change is 1.14. This indicates an increase in the rental purchasing power of the Burbank income of 14 percent even though in real terms the purchasing power of the income fell by 1.4 percent (column 3/ column 4). The calculations for the other communities can be interpreted in a like manner.

Table II-76. Selected economic factors influencing housing choice in selected communities.*

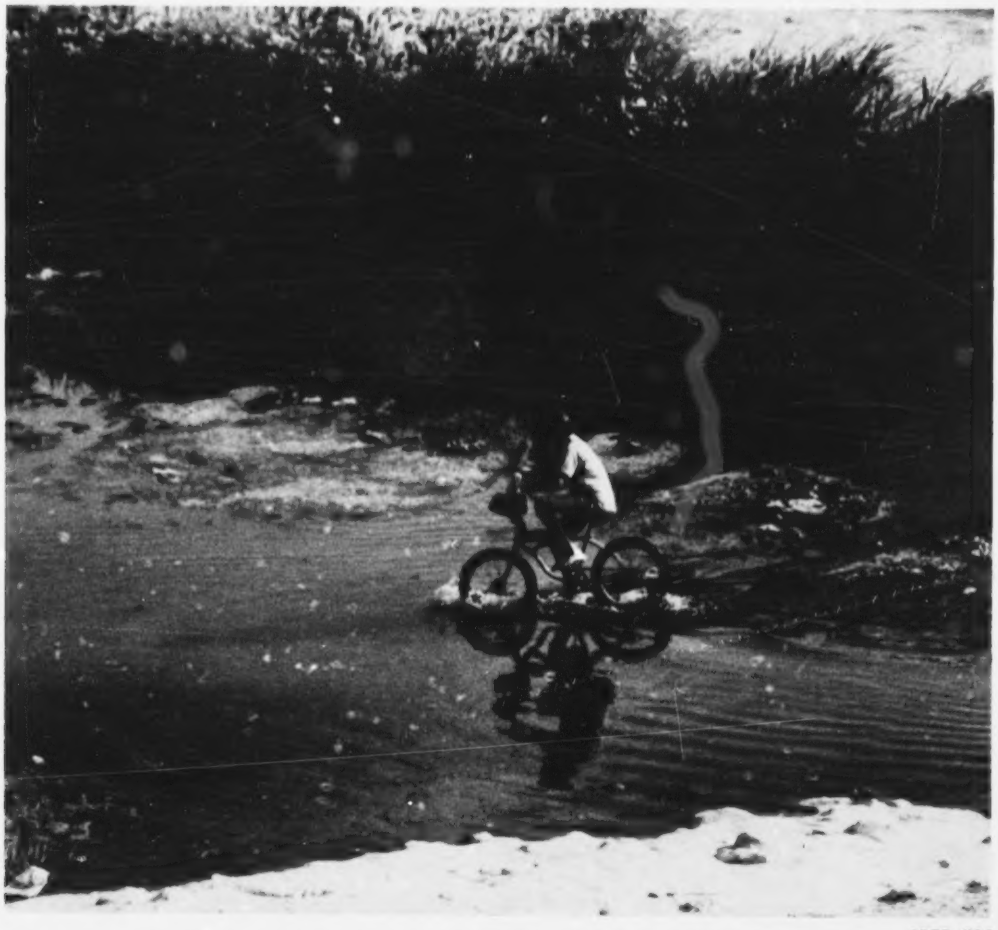
AREA	HOUSEHOLD INCOME (IN DOLLARS)		RATIO OF INCOME 1975 TO 1970	RATIO OF 1975 COST INDEX TO 1970 COST INDEX (LOS ANGELES COUNTY)	HOUSEHOLD INCOME OF 1975 SHOWN IN 1970 DOLLARS (IN DOLLARS)	RENT INDEX (1960 BASE)		RENT INDEX RATIO 1975 TO 1970	$\frac{\Delta i}{\Delta R}$ (1970-1975)	HOUSING PRICE INDEX	$\frac{\Delta i}{\Delta HP}$
	1970	1975				1970	1975				
Los Angeles County	13,974	17,063	1.22	1.39	12,275	124.2	149.7	1.20	1.02	1.475	0.827
Los Angeles City	13,059	16,163	1.24	1.39	11,649	—	—	1.20	1.03	1.475	0.841
Burbank	12,444	16,990	1.37	1.39	12,265	—	—	1.20	1.14	1.475	0.929
Glendale	12,101	15,787	1.30	1.39	11,317	—	—	1.20	1.08	1.475	0.881
San Fernando	18,127	19,771	1.09	1.39	14,214	—	—	1.20	0.91	1.475	0.739
Santa Monica	11,323	14,482	1.28	1.39	10,427	—	—	1.20	1.06	1.475	0.868

*Data not available for Beverly Hills, Culver City, and El Segundo.

SOURCES: Residential Research Committee, 1976.
Home Price Trends in Southern California, Table I-2.
Regional Planning Commission, July 1, 1972, Quarterly Bulletin.

7. RECREATION

In an arid area such as the City of Los Angeles with an average rainfall of approximately 15 inches per year, water either flowing or in a standing pool serves as a magnet for young and old alike (Figure II-134).



198P-201

Figure II-134. Water is a magnet for recreation in the Sepulveda Flood Control Basin.

This section identifies the existing recreation, both water and non-water intensive, and discusses that recreation relative to the needs of residents in the City of Los Angeles. This basic understanding of City recreation opportunities permits later focusing on the potential uses of reclaimed water in the expansion of recreation opportunities.

The role of wastewater treatment may well be changing in this decade of the 1970s from an element having a deleterious effect upon recreation during the 1950s and 1960s with beaches quarantined due to high concentrations of pathogens as a result of Hyperion effluent to a positive element promoting recreation, both water and non-water related, through the treating of wastewater to such a degree that it can be reused for irrigation and contact recreation.

Recreation in the Facilities Service Area is provided by a variety of public agencies. These agencies include the Federal Government, the State of California, the Department of Parks and Recreation, County of Los Angeles, the Los Angeles Community Colleges, the Los Angeles Unified School District, and, of course, the Department of Recreation of Parks of the City of Los Angeles. It is generally the accepted responsibility of the local government to provide parks and recreation for its citizens. In the City of Los Angeles, the responsibilities for recreation are established by charter and involve the operation, management, and control of all property owned or controlled for public recreation. The goals of the City of Los Angeles General Plan include the following broad policies for recreation:

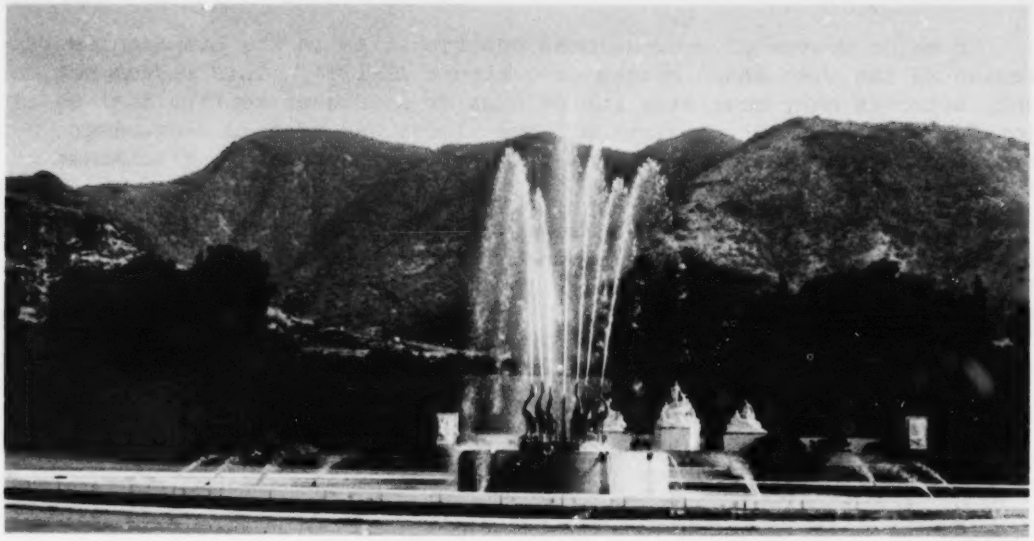
- Provide for a full range of facilities for leisure time activities at locations readily accessible to all persons;
- Furnish adequate local recreational services;
- Preserve the shoreline for public use (City of Los Angeles, Department of City Planning, 1974).

The Interim Public Recreation Plan is the current Council-approved document that sets forth standards for recreation and park sites. This plan describes service areas of one-half mile and one-mile radii for neighborhood and community sites. This conforms closely to the State of California and the National Recreation and Park Association patterns. Acreage is another determining factor for neighborhood and community sites. The interim plan prescribes a minimum of five acres for neighborhood sites and ten acres for community centers. Another important factor is the variety and scope of facilities and services provided, particularly with respect to meeting the needs of residents in different age groups.

There are five general types of recreational activities and park sites under the administration of the Los Angeles Department of Recreation and Parks: 1) cultural and educational; 2) special activities; 3) neighborhood sites for special needs of individual neighborhoods; 4) community sites to serve residents in several surrounding neighborhoods; and 5) regional parks to serve the City's residents in major areas of the City including beaches.

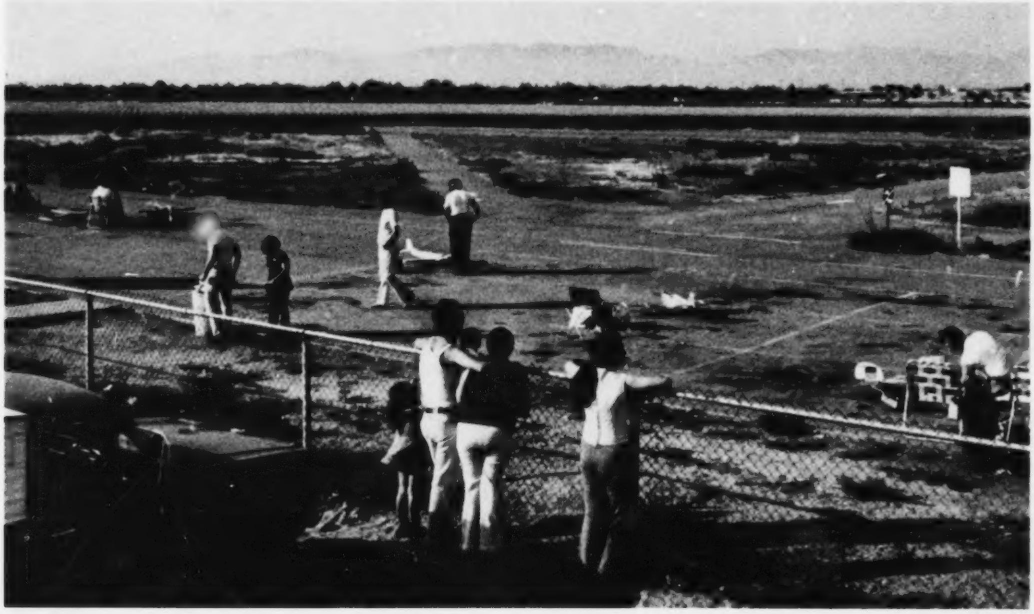
The regional parks, and to a lesser extent, the community parks, make use of water-based recreation activity. The regional park provides specialized facilities such as lakes, golf courses, campgrounds, wilderness areas and museums, which normally serve persons living throughout the City, or a major geographic division, thereof. A regional park may include, or emphasize, exceptional scenic attractions (see Figure II-135). Existing regional parks in the City can be located on the current land use map (Figure II-72).

- Elysian Park and Recreation Center is 576 acres and has recreational facilities, picnic areas, hiking trails, forested hills, and green valleys. Elysian Park is the large park west of the intersection of the Pasadena and Golden State Freeways near Central Los Angeles and serves Central City area residents, many of whom are minorities, including Orientals, those with Spanish surnames, and retired.
- Hansen Dam Recreation Area is a 1,439-acre flood control basin that is leased by the City from the Federal Government. This area has a lake for swimming, boating, and fishing, picnic areas, a golf course, and a clubhouse. Hansen Dam is in the northeastern portion of the San Fernando Valley east of the City of San Fernando and between the Verdugo Mountains and the San Gabriel Mountains. This park is proximate to the City of San Fernando and the concentrations of residents with Spanish surnames in the neighboring parts of Los Angeles.
- Harbor Memorial Park, 231.47 acres, has picnic areas, sports areas, boating and sailing, and a golf course. This park is the major recreational area for City and nonCity residents in the Harbor area. It is adjacent to the Harbor Freeway and can clearly be seen on Figure II-72.
- Griffith Park (1,882 acres) is the largest city-owned and operated park in the world; the park contains five golf courses, 16 tennis courts, a zoo, an observatory, a planetarium, a hall of science, hiking and riding trails, and numerous picnic grounds and sports areas. Griffith Park is southwest of the intersection of the Ventura and Golden State Freeways at the eastern end of the Santa Monica Mountains. Griffith Park serves residents throughout Southern California.
- Sepulveda Dam Recreation Area (2,031 acres) has a major sports field, a baseball diamond, children's play areas, tennis courts, a 20-acre picnic ground, two 18-hole golf courses, a model aircraft flight field, and a bikeway (see Figure II-136). This recreation area is in the south central portion of the San Fernando Valley northwest of the intersection of the San Diego and Ventura Freeways. This area serves the typically low minority western end of the San Fernando Valley.



198P-202

Figure II-135. The Santa Monica Mountains, with Griffith Park to the left, form a backdrop for the 30-foot high streams of water from the fountain at Forest Lawn Cemetery in Hollywood. Although not usable for recreation, such green belts and open spaces are of aesthetic benefit to the residents of the area.



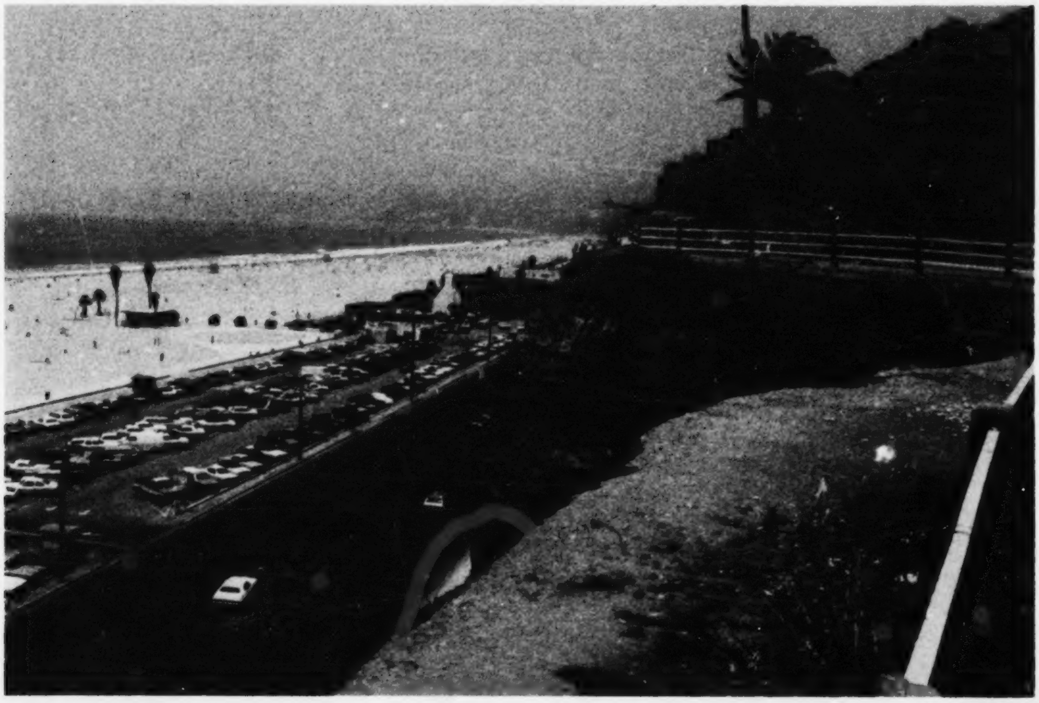
198P-42

Figure II-136. The Sepulveda Flightfield is enjoyed by those who build radio-controlled models as well as by spectators. The agriculture in the background separates the flight activities from other recreational uses.

A major source of recreational opportunities in the Los Angeles region is the vast beach system (see Figure II-137). This system not only attracts many tourists, but is a major source of recreational enjoyment for the local population. The sludge and treated wastewater from the City's wastewater system at Hyperion is presently discharged offshore from the beaches.

Beaches are categorized as regional in size for service area purposes. Some of the beaches are owned by the State and County. On 1 July 1975, operational responsibility for the beaches was assumed by Los Angeles County.

- Cabrillo Beach is 54 acres in size and is located at the Los Angeles-Ventura County border in West Malibu.
- Dockweiler Beach has a large area (274 acres) and is located near the Los Angeles International Airport.
- Royal Palms Beach has an area of 18.07 acres and is located north of San Pedro.
- Will Rogers State Beach has 78 acres and is located north of Santa Monica.



198P-208

Figure II-137. Beach areas such as this one in Santa Monica draw hundreds of thousands of visitors from throughout Southern California.

According to recent estimates, between 1967 and 1976 325 million people or 32.5 million per year availed themselves of the sun and sand that characterize Los Angeles area beaches (County Department of Beaches, 1977). Beach use appears to be a recreational activity of rapidly increasing popularity. In 1975 more than 49 million people visited beaches operated by the County. By 1976 this number had surpassed 57 million. Rapid growth in beach activity has been accompanied by an equally rapid expansion in the County operated beach system. Table II-77 illustrates the gain in County operated facilities. Presumably, County operation will assure continued public access as well as insuring their quality and maintenance.

The visitor or use estimates made by the County do not include data pertaining to the City of Long Beach or private beaches in the area. Recreational boating is also excluded from enumeration by the County. With these additions it is likely that more than 60 million visitors use the beach annually.

Historically, the quality of beach and water recreation has been affected by the ocean discharge of wastewater. In 1943 the State Department of Public Health quarantined approximately 10 miles of beach, from Hermosa Beach on the south to Venice on the north. Later in the same year, the State brought suit against the City which resulted in a Superior Court Order to construct a treatment plant that would permanently eliminate the nuisance condition. Successive connective efforts resulted in the modernization of the Hyperion Treatment Plant at Playa del Rey.

Again in the 1950's and 1960's, there were closures or threatened closures of area beaches as the result of the Hyperion effluent. Completion of the five and seven mile outfalls effectively halted the Hyperion effluent which caused beach closures. Presently, the beaches meet the water quality criteria of the Regional Water Quality Control Board. Although the quality of the water is undoubtedly affected, the attendant figures indicate that the existence of these wastewater treatment plants and their attendant ocean outfalls exercise little, if any, constraint on beach related activities.

The most recent evaluation of recreational services provided in the City of Los Angeles and the demand for such services was conducted by the City of Los Angeles Community Analysis Bureau (CAB) as part of its report entitled "The State of the City - 1975." The scope of this CAB study, however, was limited to: 1) the recreational and park resources and facilities operated by the Department of Recreation and Parks and the County of Los Angeles; and 2) the community and neighborhood park system. This limited focus was due in part to limited time and available data as well as to the lack of City Council-approved criteria for regional sites and services (City of Los Angeles Community Analysis Bureau, 1975).

As a result of its analysis, CAB concluded that serious gaps in park acreage per 1,000 people exist. Although overall city-wide figures indicate that there are 14,402 park acres, for an average of 5.12 acres per 1,000 population in the City of Los Angeles, much of the acreage is not

Table II-77. County beach areas, 1945-1976.

COUNTY BEACHES	BEACH FRONT IN MILES	BEACH ACRES
1945-1969		
Hermosa City Beach	1.7	110
Manhattan-El Porto State Beach	2.1	44
Redondo State Beach	1.6	32
Torrance State Beach	0.7	15
Marina del Rey Swim Area	0.5	6
Surfrider State Beach	0.1	1
Corral State Beach	0.7	4
Rescue Boat - King Harbor, Redondo	--	--
Rescue Boat - Paradise Cove, Malibu	--	--
Zuma County Beach	1.8	105
Pt. Vicente Fishing	0.2	10
TOTAL 1945-1969	9.4	327
Additions to County Beaches, 1969 to Present		
South Torrance Beach (July, 1969)	0.8	25
Avalon City Beach (March, 1970)	0.3	5
Rescue Boat - Avalon Harbor (March, 1970)	--	--
Malibu Lagoon State Beach (April, 1970)	0.6	36
Leo Carrillo State Beach (June, 1970)	1.3	60
Palos Verdes Beach (July, 1970)	0.5	35
Pt. Dume State Beach (March, 1971)	1.2	34
Las Tunas State Beach (July, 1971)	0.3	2
Nicholas Canyon Beach (July, 1971)	0.5	23
Pirates Cove Beach (July, 1971)	0.2	7
Malibu Pier Beach (July, 1971)	1.2	40
El Segundo Beach (September, 1972)	0.9	27
Topanga Beach (September, 1973)	1.1	43
Santa Monica State Beach (July, 1974)	2.9	129
Will Rogers State Beach (June, 1975)	3.2	87
Venice Municipal Beach (June, 1975)	2.8	238
Dockweiler State Beach (June, 1975)	3.7	255
Royal Palms State Beach (June, 1975)	0.9	18
White's Point Beach (June, 1975)	0.8	20
Point Fermin Beach (June, 1975)	1.9	2
Cabrillo Municipal Beach (June, 1975)	0.8	36
Abalone Cove Beach-Park (July, 1975)	1.3	80
TOTAL ADDITIONS SINCE 1969	27.2	1,202
TOTAL OF PRE-1969 AND POST-1969 BEACHES	36.6	1,529

usable for recreational purposes. This unusable acreage is generally located in the very large regional parks such as Hansen Dam (Figure II-138), Griffith Park, and Sepulveda Dam Recreational Area (City of Los Angeles Community Analysis Bureau, June 1975). Net acreage devoted to neighborhood or community use totals 2,417.7 acres, or 0.86 acres per 1,000 population. If the minimum standard of 2 acres per 1,000 population adopted by the City Council in its Interim Public Recreation Plan is applied, there is a city-wide deficit of 8,870.8 acres for neighborhood and community parks. In addition, although recreational park sites are located in all areas of the City, the acreage and available facilities are not evenly distributed.

CAB found that there are concentrations of parks with overlapping service areas in the San Pedro area, south central, central, and east-northeast areas of the City, and, to a more limited extent, in other areas. The irregular pattern of site locations for recreation and park sites, including concentrations and overlapping of service areas, contributes considerably to the "gaps" in recreational opportunities in areas not so fully covered. However, the locations of certain of these sites, such as the Sepulveda Recreation area, as well as the beaches, are distant from the concentrations of low-income people who also have very limited mobility. As a result, they are, for practical purposes, not readily available to the majority of low-income residents.

198P-204

Figure II-138. The Hansen Flood Control Basin in the northeastern end of the San Fernando Valley is flanked by the Verdugo Mountains on the southeast (left of photograph) and the San Gabriel Mountains to the north. This recreation area is relatively accessible to the lower income residents of the east central Valley but is remote for central Los Angeles residents.

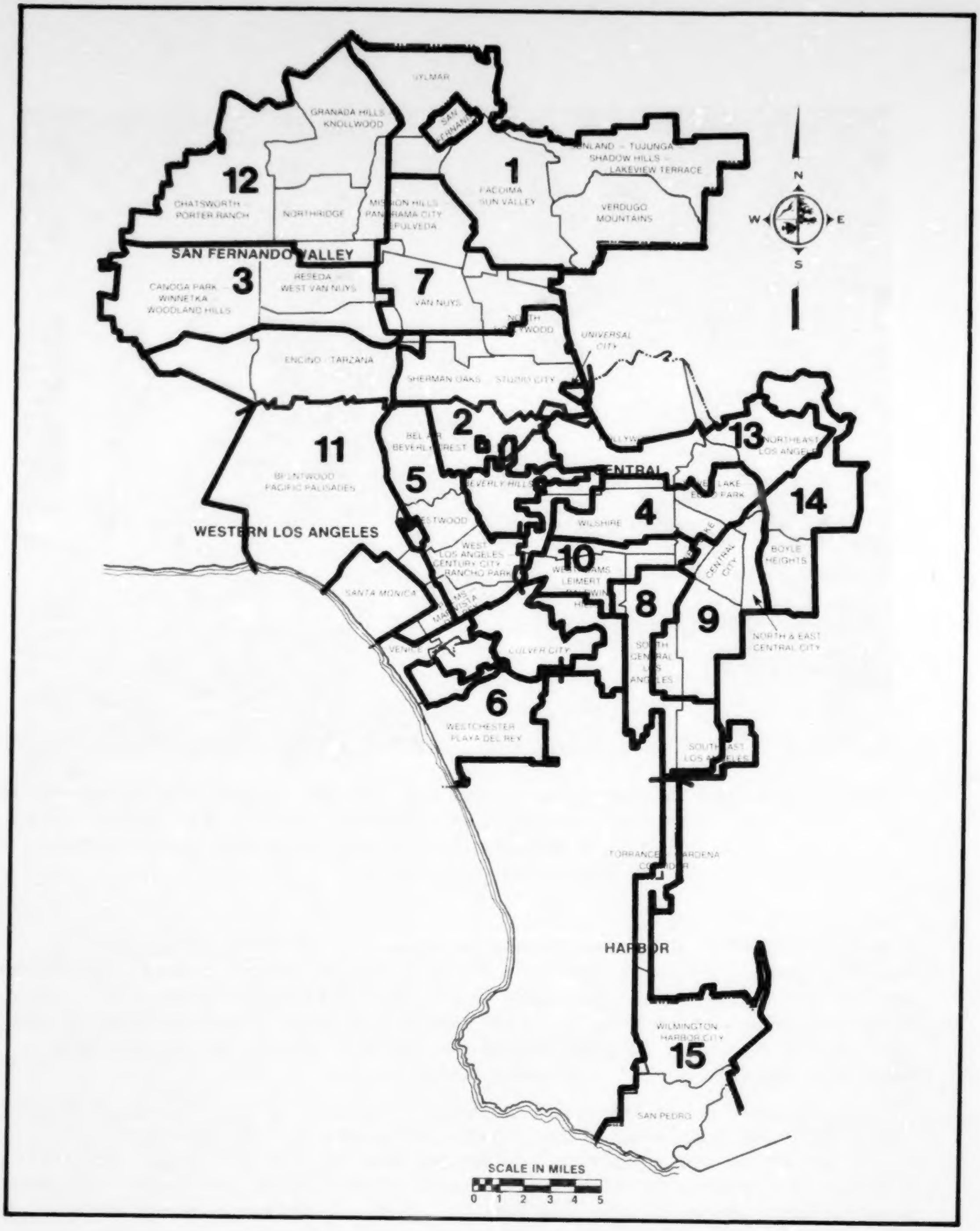
The total park acreage by Council District and the CAB estimates of deficits in neighborhood and community site acreage are given in Table II-78.

Table II-78. Deficits in park acreage by Council District (City of Los Angeles Community Analysis Bureau, 1975).

COUNCIL DISTRICT	NET NEIGHBORHOOD ACREAGE	DEFICIT PER STANDARD	NET COMMUNITY ACREAGE	DEFICIT PER STANDARD	TOTAL DISTRICT (NEIGHBORHOOD AND COMMUNITY)
1	180.47	-197.93	53.51	-324.89	-522.82
2	56.92	-301.88	125.66	-233.32	-535.20
3	104.62	-276.38	179.08	-201.92	-478.30
4	185.80	-182.00	72.44	-295.30	-477.30
5	16.79	-357.81	40.00	-344.20	-702.01
6	26.86	-352.54	22.42	-356.98	-709.52
7	32.40	-330.40	72.70	-290.10	-620.50
8	22.68	-367.12	67.44	-332.36	-699.48
9	29.76	-366.44	48.52	-317.60	-684.04
10	35.32	-350.68	28.33	-357.67	-708.35
11	29.76	-349.84	86.72	-292.88	-642.72
12	148.96	-224.44	139.41	-233.99	-458.43
13	47.15	-334.45	82.86	-298.74	-633.19
14	67.74	-311.66	155.81	-233.59	-545.25
15	133.97	-236.63	123.59	-267.01	-503.64
Totals	1,119.20	-4,540.20	1,298.49	-4,380.55	8,920.75

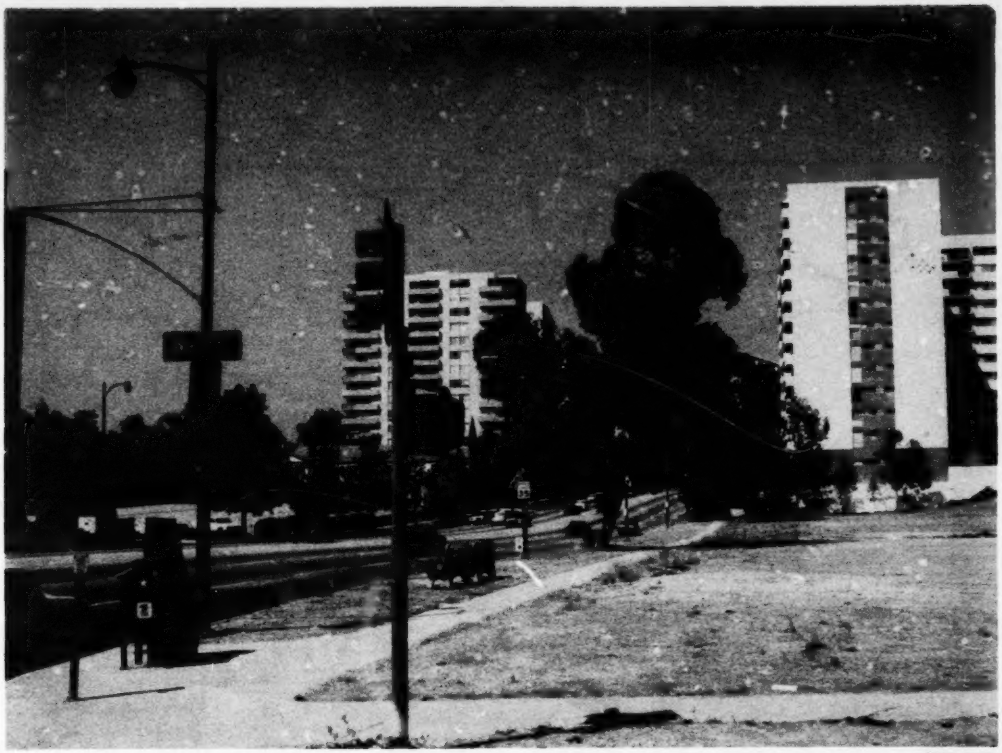
The location of these Council Districts is described with reference to the 35 planning areas map, Figure II-139. The Districts are discussed in descending order of their CAB-determined total needed acreage. Council District 6 is located along the coast, south of Santa Monica with access to public recreation along the beach but little other recreational alternatives. Council Districts 10 and 5 are in West and Central Los Angeles with single-family residential areas, but growing concentrations of apartments (see Figure II-140).

Districts 8 and 9, in south central and southeast Los Angeles, are older residential districts with concentrations of minority populations. Council District 11, listed with a total deficit of 642.72 acres, is the


SYLMAR
GRANADA HILLS – KNOLLWOOD
SAN FERNANDO
12
1
CHATSWORTH – PORTER RANCH
NORTHRIDGE
MIS ION HILLS – PAN RAMA CITY – EPULVEDA
PACOIMA SUN VALLEY
NLAND – TUJUNGA – SHADOW HILLS – LAKEVIEW TERRACE
VERDUGO MOUNTAINS
SAN FERNANDO VALLEY
3
CANOGA PARK – WINNETKA – WOODLAND HILLS
RESEDA – WEST VAN NUYS
7
VAN NUYS
NORTH WOOD
UNIVERSAL CITY
ENCINO – TARZANA
SHERMAN OAKS – STUDIO CITY
2
11
BEL AIR BEVERLY CREST
13
NORTHEAST LOS ANGELES
CENTRAL
BRENTWOOD – PACIFIC PALISADES
5
BEVERLY HILLS
ECHO PARK
14
WILSHIRE
4
WESTERN LOS ANGELES
WESTWOOD
WEST LOS ANGELES – CENTURY CITY – RANCHO PARK
10
BOYLE HEIGHTS
CENTRAL CITY
SANTA MONICA
LEIMERT
8
9
NORTH & EAST CENTRAL CITY
VENICE
CULVER CITY
SOUTH CENTRAL LOS ANGELES
6
WESTCHESTER PLAYA DEL REY
SOUTHEAST LOS ANGELES
TORRANCE – GARDENA CORRIDOR
HARBOR
WILMINGTON – HARBOR CITY
15
SAN PEDRO
N
W
E
S
SCALE IN MILES
0 1 2 3 4 5

198P-205

Figure II-139. Fifteen Council Districts within the City of Los Angeles.



198P-206

Figure II-140. In Districts 10 and 5 along the Wilshire Corridor there is some vacant land, although this is filling in with high-rise apartments. These residents need community parks and local open space.

Pacific Palisades area with potential undeveloped mountainous area but few city parks. Council District 13 is a linear district that goes from Hollywood through the Silver Lake area into northeast Los Angeles. This district, adjacent to both the Griffith and Elysian Regional Park recreation areas, has many retired residents who can and do, when available, make considerable use of community parks.

District 7 is in central San Fernando Valley around Van Nuys, Panorama City, and Sepulveda. The mobile residents in this district have ready access to the Sepulveda and Hansen Dam Recreation Areas. Council District 2 includes Griffith Park, parts of Hollywood and North Hollywood, Sherman Oaks, Studio City, and Beverly Glen. District 1 abuts the Angeles National Forest and includes the Hansen Dam Recreation Area. Sylmar, Sunland, Sun Valley, Tujunga, and Pacoima are all within District 1. District 15 includes the entire Harbor area which has some beach recreation west of the industrialized harbor. District 3 is the southwest

Valley that includes the Sepulveda Dam Recreation Area and Canoga Park, Winnetka, Reseda, and Tarzana. District 4 includes the Wilshire Corridor with commercial and some multi-family residential development. This area has little recreational acreage. District 12 is the northwest San Fernando Valley with large tracts of single family residences but little or no public park facilities (see Figure II-141).

The availability of reclaimed water could increase the recreation possibilities at the large recreation areas including Griffith Park and the Sepulveda Dam area. The City is also in need of smaller community facilities that encourage nearby walks and local bicycling rather than chiefly automobile-dependent large recreation areas.

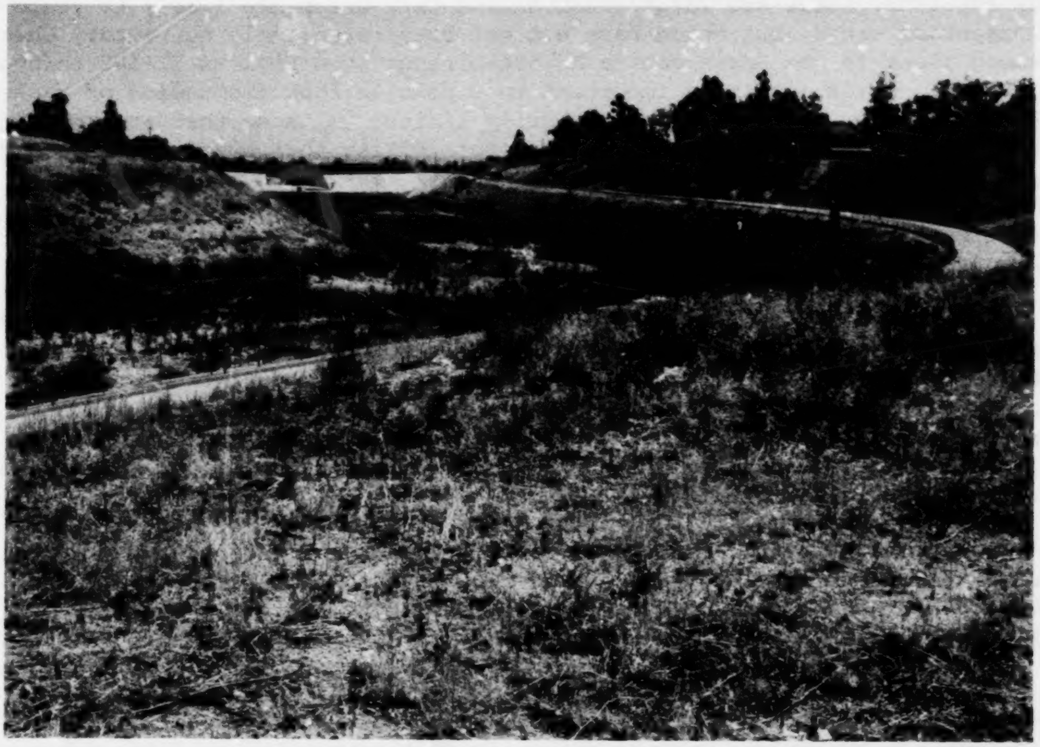

198P-143

Figure II-141. Unlined flood control channels, such as this one on Limekiln Creek in the northern San Fernando Valley, provide residents with green belts and enterprising youngsters who scale the fence for recreation.

8. CULTURAL RESOURCES

Historical, paleontological, and archaeological sites and structures are numerous throughout the Los Angeles wastewater service area. There are over 245 known historical structures or places of interest in the entire service region officially recognized or potentially definable as preservable under historical preservation ordinances. There are also over 70 known paleontological sites where fossils have been recorded and well over 100 archeological sites within Los Angeles City boundaries alone. In addition, there are large areas of the City which are likely to yield unrecorded sites, but which have not yet been extensively surveyed. Chief among these is the Santa Monica Mountain range (see Figures II-142 through II-144). It is extremely important to emphasize that discussion of these kinds of sites and areas is necessarily limited to those that are known and have been identified. There is every possibility that numerous other sites and structures exist and sensitivity to this likelihood must be employed by all involved in the design and construction of the major alternatives. Full copies of the archaeologist's report and of the historic-cultural documents are in Appendix IV-A.

Known cultural historical sites are scattered throughout Los Angeles and most of the seven contract cities which compose the service area. Most of these historical structures or areas are concentrated in a wide band from Santa Monica, through Beverly Hills, including downtown Los Angeles and northwest along the Pasadena Freeway toward South Pasadena. The remainder are clustered in or around San Pedro, and dispersed throughout the San Fernando Valley.

Figure II-142 indicates the approximate locations of known historical sites and the seven components to the wastewater facilities plan: the Hyperion Treatment Plant in El Segundo, the Sepulveda Water Reclamation Plant and the Sepulveda Dam Recreation Area Reclaimed Water Delivery System north of the Ventura Freeway, the La Cienega Water Reclamation Plant south of Washington Boulevard, the AVORS tunnel alignment through the Santa Monica Mountains, the Los Angeles-Glendale Water Reclamation Plant south of Colorado Boulevard, and the two units of the East Valley Interceptor Sewer (EVIS I and II) along Woodman Avenue. A number of historical sites are located proximal to these proposed facilities or to their additions and will be discussed in detail here. These are only the known sites and may be indicative of other undesignated sites with potential historic or cultural interest.

Two sites are in close proximity to the projects proposed for the Sepulveda Dam Recreation Area: Rancho El Encino in the Los Encinos State Historic Park at 16756 Moorpark Avenue, and an oak tree on Louise Avenue two hundred feet below the Ventura Freeway. Rancho El Encino is registered

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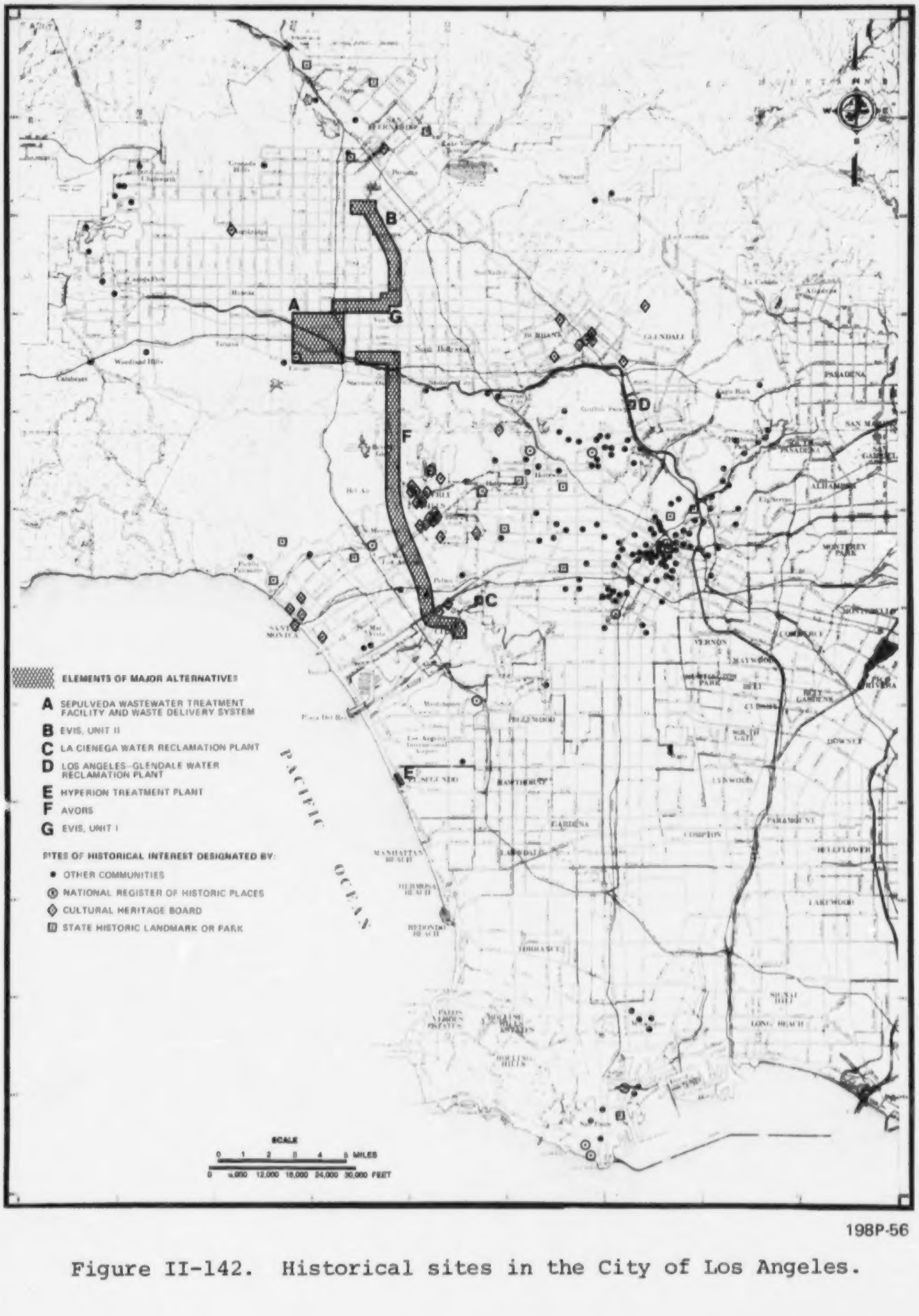
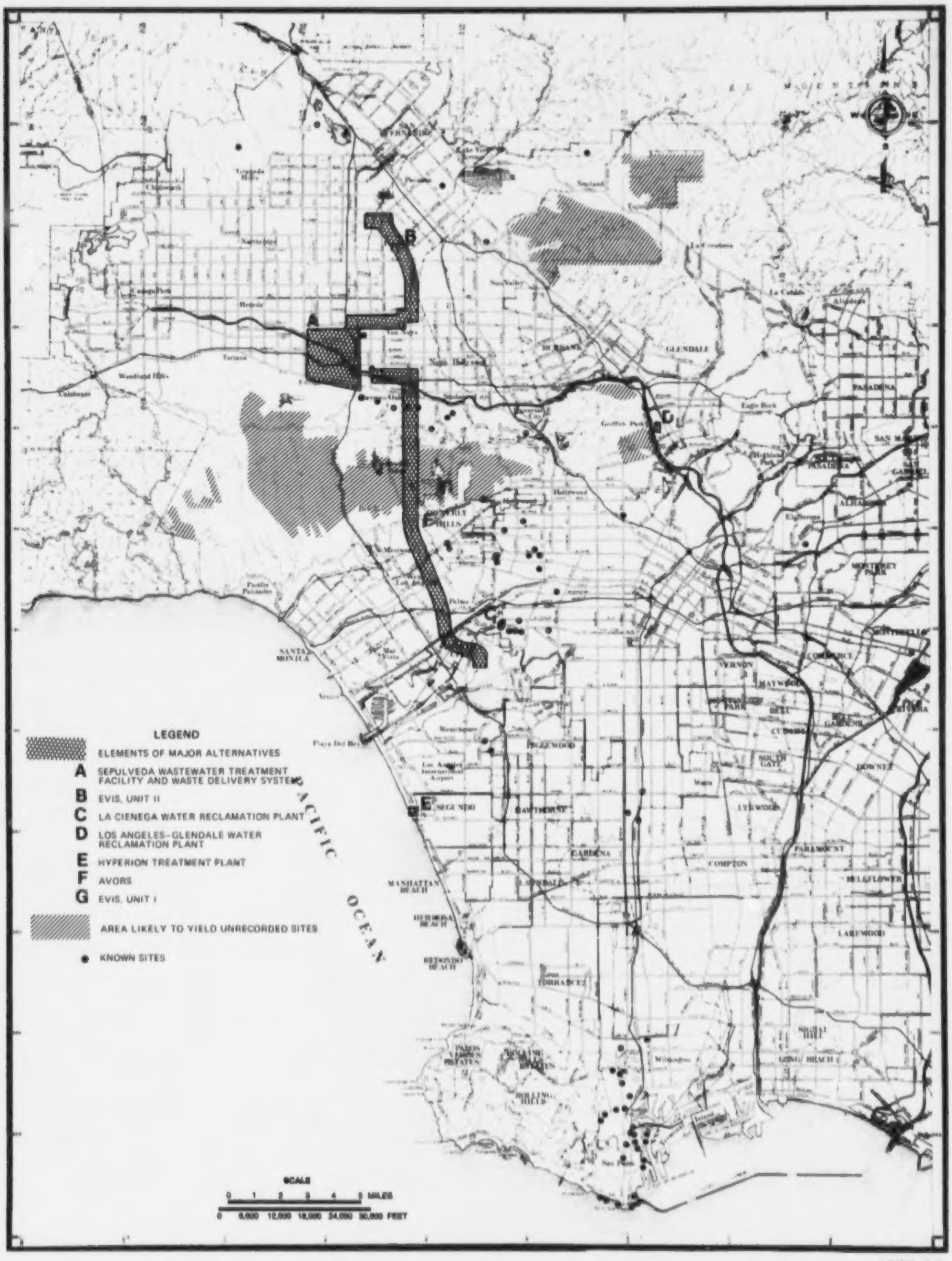

ELEMENTS OF MAJOR ALTERNATIVES
A SEPULVEDA WASTEWATER TREATMENT FACILITY AND WASTE DELIVERY SYSTEM
B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES–GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
SITES OF HISTORICAL INTEREST DESIGNATED BY:
● OTHER COMMUNITIES
◎ NATIONAL REGISTER OF HISTORIC PLACES
◈ CULTURAL HERITAGE BOARD
▣ STATE HISTORIC LANDMARK OR PARK
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET
PACIFIC OCEAN
SANTA MONICA
GLENDALE
PASADENA
VERNON
COMPTON
GARDENA
TORRANCE
LONG BEACH
HAWTHORNE
EL SEGUNDO
MANHATTAN BEACH
HERMOSA BEACH
REDONDO BEACH
DOWNEY
LAKEWOOD
BELLFLOWER
PARAMOUNT
LYNWOOD
MAYWOOD
MONTEREY PARK
ALHAMBRA

198P-56

Figure II-142. Historical sites in the City of Los Angeles.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▨ ELEMENTS OF MAJOR ALTERNATIVES
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B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES-GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
▨ AREA LIKELY TO YIELD UNRECORDED SITES
● KNOWN SITES
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INGLEWOOD
GARDENA
COMPTON
TORRANCE
MANHATTAN BEACH
HERMOSA BEACH
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VERNON
DOWNEY
PARAMOUNT
LAKEWOOD
BELLFLOWER
LONG BEACH
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198P-57

Figure II-143. Paleontological sites in the City of Los Angeles.

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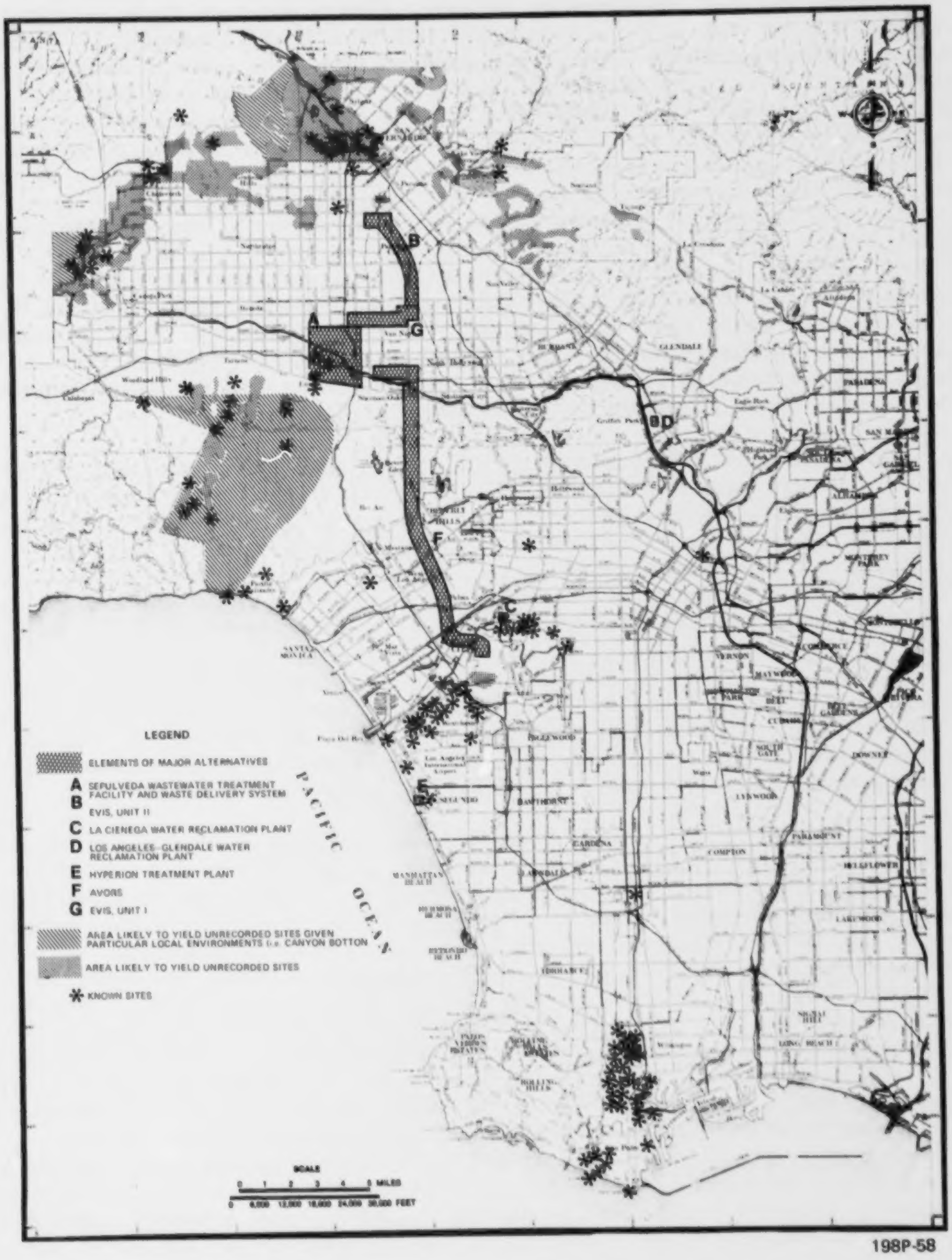

PACIFIC OCEAN
LEGEND
ELEMENTS OF MAJOR ALTERNATIVES
A SEPULVEDA WASTEWATER TREATMENT FACILITY AND WASTE DELIVERY SYSTEM
B EVIS, UNIT II
C LA CIENEGA WATER RECLAMATION PLANT
D LOS ANGELES–GLENDALE WATER RECLAMATION PLANT
E HYPERION TREATMENT PLANT
F AVORS
G EVIS, UNIT I
AREA LIKELY TO YIELD UNRECORDED SITES GIVEN PARTICULAR LOCAL ENVIRONMENTS i.e. CANYON BOTTON
AREA LIKELY TO YIELD UNRECORDED SITES
✱ KNOWN SITES
SCALE
0 1 2 3 4 5 MILES
0 6,000 12,000 18,000 24,000 30,000 FEET

198P-58

Figure II-144. Archaeological sites in the City of Los Angeles.

on both the National Register of Historic Places and the State Historic Parks list; the oak tree is a Cultural Heritage Board Landmark. Approximately 22 historical structures are located along the western boundary of the City of Beverly Hills. These sites are not officially designated but rather are part of a longer list of "sites of historical and archaeological interest." Their distance from the proposed AVORS tunnel route precludes the probability that their locations would be affected. In Culver City, two remaining vestiges of the one-time movie industry there are proximal to the trench portion of the AVORS alignment. The Metro-Goldwyn-Mayer Studio gate at 10202 Washington Boulevard and the INCE/Culver City Studio building located at 9336 Washington Boulevard are both in the immediate trench vicinity. The gates were made a historically-designated site in 1967, while the studio building, also known as the "Desilu Building," has been submitted for National Register consideration. Known historical sites are not apparent near other components of the proposed wastewater facilities; however, potential sites could in fact exist.

Archaeological and paleontological sites also range across the area serviced by the proposed facilities. Known archaeological sites are clustered around the coastal and river bed areas of San Pedro, along the length of Ballona Creek, and on the Western perimeter of Los Angeles following the Santa Monica and Santa Susana Mountain ranges shown in Figure II-144. Known fossil sites are clustered near the harbor and contributing river bed, also north and east of Culver City, along the north slope of the Santa Monica Mountains, and across the top of the San Fernando Valley as shown in Figure II-143. Both potential archaeological and paleontological sites exist in large sections of the service area, but sufficiently detailed assessments have not yet been carried out. These sections are centered in portions of the Santa Monica, Santa Susana and San Gabriel Mountain ranges that border the urbanized metropolis.

Specifics of the archaeological and paleontological sites are not permitted to be discussed, but can be obtained by contacting the District Clearinghouse of the UCLA Archaeological Survey and the Los Angeles County Natural History Museum. Identification of sites is made by number codes only. Of the known archaeological sites, six are located within two miles of the open trench section of the AVORS alignment. These are 4-LAn-55, 4-LAn-53, 4-LAn-56, 4-LAn-57, 4-LAn-58, and 4-LAn-68. No known sites are located proximal to the proposed AVORS tunnel project. Within two miles of the Hyperion Treatment Plant exist sites 4-LAn-204, 4-LAn-205, 4-LAn-206, 4-LAn-64, 4-LAn-65, 4-LAn-62, 4-LAn-211, 4-LAn-61, 4-LAn-212, and 4-LAn-9. This last site is within one quarter mile of the project area. The proposed La Cienega Water Reclamation Plant location is perhaps in the most archaeologically sensitive area of all the proposed facilities. Within five miles of the proposed facility are sites 4-LAn-204, 4-LAn-203, 4-LAn-206, 4-LAn-65, 4-LAn-64, 4-LAn-62, 4-LAn-211, 4-LAn-61, and 4-LAn-212, and many of these are within close proximity to the project site. Two sites are within two miles of the Sepulveda projects, 4-LAn-343 and 4-LAn-43. No known sites are apparent near the Los Angeles-Glendale addition nor in the vicinity of the EVIS I and II alignments.

Paleontological sites shown in Figure II-143 are known to be in the vicinity of the EVIS II alignment and the Sepulveda projects as well as the AVORS tunnel and the La Cienega facility. Paleontological sites numbered 3822 and 3263 are close to both the Sepulveda Dam Recreation area and to the AVORS tunnel where it approaches the Sepulveda facilities. Sites numbered 1408 and 7022 are proximal to the AVORS tunnel where it burrows through the Santa Monica Mountains. Although known sites have been recorded only on the north slope of these Mountains, the south slope is considered to be an area likely to contain paleontological sites. The AVORS tunnel alignment passes through both areas. The La Cienega facility is located in an area of numerous paleontological as well as archaeological sites. Those numbered 3368, 3367, and 3370 are the closest of several in the vicinity. The remaining proposed facilities or additions do not appear to be situated in close proximity to known sites.

Predicted effects upon known sites vary with the type of site, construction, and impact. The tunnel and trench alignments are not expected to adversely affect existing historic and cultural sites directly due to the underground pathways of these facilities, many of which will follow existing roadways. The trench and tunnel alignments are also not expected to directly disturb known surface archaeological and paleontological sites There is, however, a strong possibility that subsurface sites will be unearthed by construction of these alignments, given the numerous sites known to exist above ground. If archaeological or paleontological resources are discovered in the course of construction of any part of the project, cessation of the activity should occur until a proper evaluation by the appropriate experts can be made. Due to the possibility of this occurrence, all construction plans should be coordinated with knowledgeable authorities in the fields of historical preservation, archaeology and paleontology.

Additions to the Los Angeles-Glendale and Hyperion plants are not expected to produce direct impacts on known historical resources in their respective areas. However, that possibility does exist with the Sepulveda and La Cienega projects. Both water reclamation plants are projected to be built in areas possessing a fair number of known historical, archaeological or paleontological sites. Construction of the La Cienega plant in particular, whose exact location has not yet been determined, may disinter archaeological and paleontological resources similar to those already unearthed in the area.

Indirect impacts upon all these types of historical resources may well be established by the wastewater facilities plan. The construction of new facilities or additions to existing plants may encourage continued growth especially in the fringe areas where vacant land is still obtainable. The foothills and low mountain areas on the southern, western, and northern peripheries of the San Fernando Valley contain both developable lots and numerous recorded archaeological and fossil sites. Unrecorded sites could easily be present in these areas as well. The overall lack of large amounts of developable land and the increased capacity of wastewater facilities generated by construction of these facilities may also result in the demolition of older structures. Some of these could hold potential as candidates for preservation at some future point under any of the historical conservation laws. The potential adverse impacts on all sites of historical interest by private developments will be harder to anticipate and control than those direct effects generated by construction of the facilities that encourage this development.

9. QUALITY OF THE COMMUNITY ENVIRONMENT

a. Summary of Regional Results. In any community, and particularly a large one, such as Los Angeles, amenities available to different geographical areas may vary considerably. An identification of these amenities and an estimate of their effects on individuals is required to estimate the intracommunity locational decisions so that services, including wastewater treatment, can be planned to direct those decisions in an environmentally sound manner.

The relative distribution of the population within the Community Planning Areas between the Census years of 1960-1970 offers a suggestion regarding the desirable residential locations. Table II-79 identifies this growth by the four city regions. As can be seen, the lowest absolute growth occurred in the Harbor (southern) area with the main areas of negative growth in the Central City. The San Fernando Valley grew by almost twice as much as the rest of the city combined with activity centered in the Chatsworth-Porter Ranch and Canoga Park, Winnetka, Woodland Hills/West Valley areas. Combined individual decision regarding residential location and availability of residential opportunities suggest that the San Fernando Valley, and particularly the west end of the valley, has a desirable "Community Environment."

At present, no composite measure exists to define the "quality" of an environment and there is no consensus as to what constitutes "quality." Although no designation of one community as having more "quality" than others can go without challenge, various quantitative criteria and general descriptions can be given for each community to provide information on the socioeconomic conditions likely to be found in the area and suggest the desirability of the area in residential location decisions.

The analysis regions incorporated in this discussion are basically those of the Community Analysis Bureau of the City of Los Angeles although similar adjacent communities have been grouped to minimize redundancies. Basic data on each community have been summarized in Table II-80. In many cases, particularly in the San Fernando Valley, Community Analysis Bureau areas differ from those used by the City Planning Department since CAB areas have generally remained constant since 1960 while planning department areas change frequently. The CAB areas and the median family income are given in Figure II-145; the median home values are shown in Figure II-146.

The six main variables included in this discussion are based on the Community Analysis Bureau's evaluation of census tract data. In most cases these variables reflect a composite score on several other variables. Other criteria, not generally applicable to the entire city, have also been noted. The variables included in the analysis are:

Table II-79. Growth by community planning area, 1960-1970.

AREA	GROWTH/AREA (percent)	GROWTH DIFFERENCE (people)
Central		
N.E. Los Angeles	7.4	14,233
Boyle Heights	0.3	211
S.E. Los Angeles	-4.7	-9,286
W. Adams/Leimert	-4.8	- 809
South Central	1.6	3,806
Wilshire	-0.8	-1,593
Hollywood	0.6	943
Silverlake	11.7	8,079
Westlake	0.2	122
Central City	61.4	11,124
North and East Los Angeles	-2.5	- 220
Portion of Total City Growth	0.9	27,610
San Fernando Valley		
Sherman Oaks-Studio City	1.7	1,385
North Hollywood	5.1	4,784
Pacoima-Sun Valley	3.1	3,277
Van Nuys	8.6	8,792
Mission/Panorama City	4.9	5,386
Verdugo Mountains	3.6	584
Sylmar	5.3	2,263
Granada Hills/Knollwood	6.8	3,696
Canoga/Winnetka Woodland Hills	18.1	25,228
Chatsworth/Porter Ranch	58.2	31,042
Northridge	9.0	3,685
Reseda/W. Van Nuys	7.1	5,967
Encino/Tarzana	15.2	9,956
Sunland/Tujunga/Shadow Hills	4.4	1,724
Portion of Total City Growth	3.6	107,769

Table II-79. (continued).

AREA	GROWTH/AREA (percent)	GROWTH DIFFERENCE (people)
Western		
Westwood	5.0	1,757
W. Los Angeles/ Century City	3.2	2,213
Palms/Mar Vista	4.6	4,532
Venice	18.6	7,084
Westchester/ Playa Del Rey	0.5	263
Brentwood/Pacific Palisades	12.7	7,035
Bel Air/Beverly Crest	4.3	784
Portion of Total City Growth	0.8	23,668
Southern		
Wilmington/Harbor City	6.3	3,475
San Pedro	4.4	3,274
Torrance/Gardena	3.0	1,022
Portion of Total City Growth	0.3	7,711
TOTAL CITY GROWTH	5.6	165,818

Source: 1960 Census, 1970 Census.

Table II-80. Summary of quality of community environment ranking criteria for 65 planning areas in six analysis zones.

SAN FERNANDO VALLEY							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUE	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RANKING	OTHER COMMENTS
Canoga Park	moderate to high	middle	low to moderate	high to average	average to high	Excellent	
Chatsworth	middle to high	middle to high	low	high to average	average to high	Excellent	Potential for further development.
Granda Hills	middle to high	middle to exclusive	low	high to near average	average to high	Excellent	
North Hollywood	moderate to high	middle to high	low to moderate	high to average	average to high	Good	Influenced by Glendale-Burbank. Many apartment units.
Northridge	middle to high	middle to exclusive	low to moderate	high to average	average to high	Excellent	University of California - Northridge.
Pacoima	low to middle	low to middle	moderate to high	below average	low to high	Variable	Black cluster. 53% minority. Location of federally subsidized housing project in 1950's.
Porter Ranch	high	high	low	near average	average to high	Excellent	Relatively undeveloped.
Reseda	moderate to middle	middle	moderate	average	average	Good	Concentration of employment.
Sepulveda	moderate to high	middle	low to moderate	average	average to high	Excellent	
Sun Valley	moderate to high	low to high	low	average to below average	average to high	Good	20% minority.
Sunland	middle to high	low to high	low	average	average to high	Good	
Sylmar	moderate to high	low to high	low	average to below average	low to high	Fair	20% minority. Potential for further development.
Tujunga	moderate to middle	low to middle	low	average	average	Good	
Van Nuys	moderate to high	low to high	low to moderate	average	average to high	Good	Concentration of employment. Many apartment units. Governmental administrative centers.
Woodland Hills	middle to high	middle to exclusive	low	average to high	high	Excellent	Potential for further development.

Table II-80. (continued)

CENTRAL CITY							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUES	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RANKING	OTHER COMMENTS
Avalon	low	low	high	below average	low	Poor	99% minority.
Boyle Heights	low to moderate	low	high	below average	low	Poor	Spanish cluster. 92% minority. Preventive fire rate >90%.
Central	low	low	high	below average	low	Poor	Many apartments.
Downtown	low	moderate & exclusive (2)	low	below average	(1)	Poor	Civic Center location. Many jobs. Few residences. Skid row. Preventable fire rate >90%.
Elysian Park	low to moderate	low to moderate	moderate	below average	low	Fair	Many apartments.
Exposition	low to moderate	low	high	below average	low	Poor	Black cluster. 96% minority. Many apartments.
Green Meadows	low to moderate	low	high	below average	low	Poor	Black Cluster. 96% minority. Primarily single-family homes. Preventive fire rate >90%.
Lincoln Heights	low to moderate	low	moderate	below average	low	Fair	Spanish cluster. 82% minority.
Santa Barbara	low	low to moderate	high	below average	low to average	Poor	Black cluster. 85% minority.
University	low	low to moderate	low to high	below average	low	Poor	Many jobs. Many apartments.
Watts	low	low	high	below average	low	Poor	Black cluster. 98% minority. Preventable fire rate >90%.
West Lake	low	low to moderate	high	below average	low to average	Poor	Spanish cluster. Many apartments.
Wholesale	low	(3)	low	below average	low	Poor	Black cluster. Many jobs.
South Vermont	low to middle	low to moderate	moderate to high	average to below average	average to low	Poor to Fair	Black cluster. 92% minority. Primarily single-family homes. Preventable fire rate >90%.

[1] Since few schools are located in the downtown tracts, no educational ranking is made.

[2] Only two census tracts located in the Downtown area have sufficient home values to be meaningful.

[3] The number of reported home values was not sufficient to be meaningful.

Table II-80. (continued)

WEST LOS ANGELES							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUES	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RANKING	OTHER COMMENTS
Del Rey	moderate to high	moderate	moderate to high	average	low to average	Fair	Many high-rise apartments. Young singles. Location of Marina Del Rey.
Del Rey Palisades	high	high	low	average	high	Excellent	Borders L.A. International Airport. High-rise apartments and condominiums.
Mar Vista	moderate to high	moderate to high	moderate to high	average	average high	Excellent	Many apartments.
Palms	moderate to high	moderate to exclusive	moderate to high	high to average	low to high	Excellent	Local urban renewal projects. Many apartments.
Venice	low to middle	low to high	high	below average	low to average	Fair	"Bohemian" district. Many apartments. Beach area. Preventable fire rate >90%.
West Los Angeles	moderate to high	moderate to high	moderate to high	average	average to high	Excellent	Many apartments. Century City business district.
Westchester	moderate to high	moderate to high	low to moderate	average	average to high	Excellent	Location of L.A. International Airport. Hughes Aircraft Installation, and Loyola University. Many jobs.
Westwood	middle to high	high to exclusive	moderate to high	high	high	Excellent	Near UCLA. Movie Theater district. Mixed residential development, older homes - new apartments.

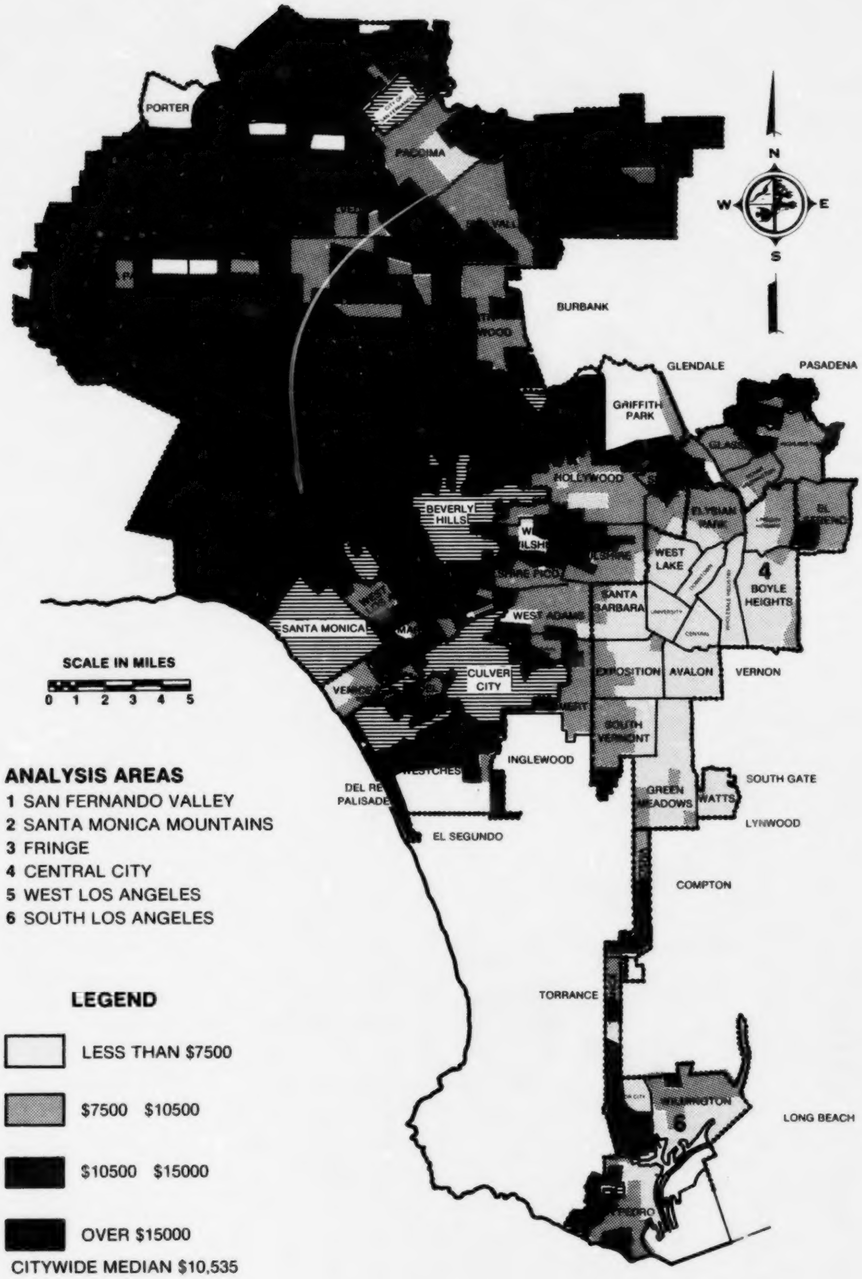
SOUTH LOS ANGELES							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUES	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RATING	OTHER COMMENTS
Gardena	moderate to middle	low to moderate	low to moderate	average	average	Good	Japanese cluster. Mixed ethnic.
Harbor City	low to middle	low to moderate	low	below average	low to average	Poor	Mixed ethnic.
San Pedro	low to high	low to high	low to high	variable	low to high	Fair	Spanish cluster.
Torrance	low to middle	moderate	low to moderate	below average	average	Good	Large percentage of housing units are in apartment complexes. Mixed ethnic.
Wilmington	low to middle	low to moderate	low	average to below average	low to average	Poor	Spanish cluster.

Table II-80. (continued)

THE FRINGE							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUES	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RANKING	OTHER COMMENTS
Atwater	moderate to middle	low to moderate	moderate	below average	average to low	Fair	
Baldwin	moderate	moderate to high	moderate	above average	average	Fair to Good	Black cluster. 77% minority population.
Eagle Rock	moderate to middle	low to moderate	low	average	average	Good	
El Sereno	moderate to middle	low to moderate	moderate to high	below average	average to low	Fair	Spanish cluster. Blue collar employed. 79% minority.
Glassel	moderate to middle	low to moderate	moderate	average	average	Good	
Griffith Park	moderate and high	moderate & exclusive	moderate	average	average to high	Good	Accessible to recreation.
Highland Park	moderate to middle	low to moderate	moderate	below average	average	Fair	
Hollywood	low to high	low to exclusive	low to high	variable	average to high	Fair to Good	Predominantly apartment dwellings.
Leimert	moderate to middle	low to high	moderate to high	variable	average to low	Fair	Black cluster. 82% minority population. Large numbers of female heads of families.
Mount Washington	moderate	low	moderate	below average	average to low	Fair	Mixed ethnic. 61% minority.
Silver Lake	moderate to middle	low to high	moderate	average to below average	average to low	Fair	Mixed ethnic. Many apartments.
West Adams	moderate to middle	low to moderate	moderate to high	average to below average	average to low	Fair	Black cluster. 89% minority population. Large numbers of female heads of families. Many apartments.
West Wilshire	low to high	moderate to exclusive	moderate to high	above average	average	Excellent	High concentrations of senior citizens and apartments.
Wilshire	high	low to exclusive	high	variable	average to low	Good	"Mirace Mile" financial and community strip located along Wilshire Boulevard.
Wilshire-West Pico	moderate to middle	moderate to high	moderate to high	average	average to low	Fair	Many apartments.
West Hollywood	high	high to exclusive	low	high	average to high	Good	Large Jewish community. Many apartments.

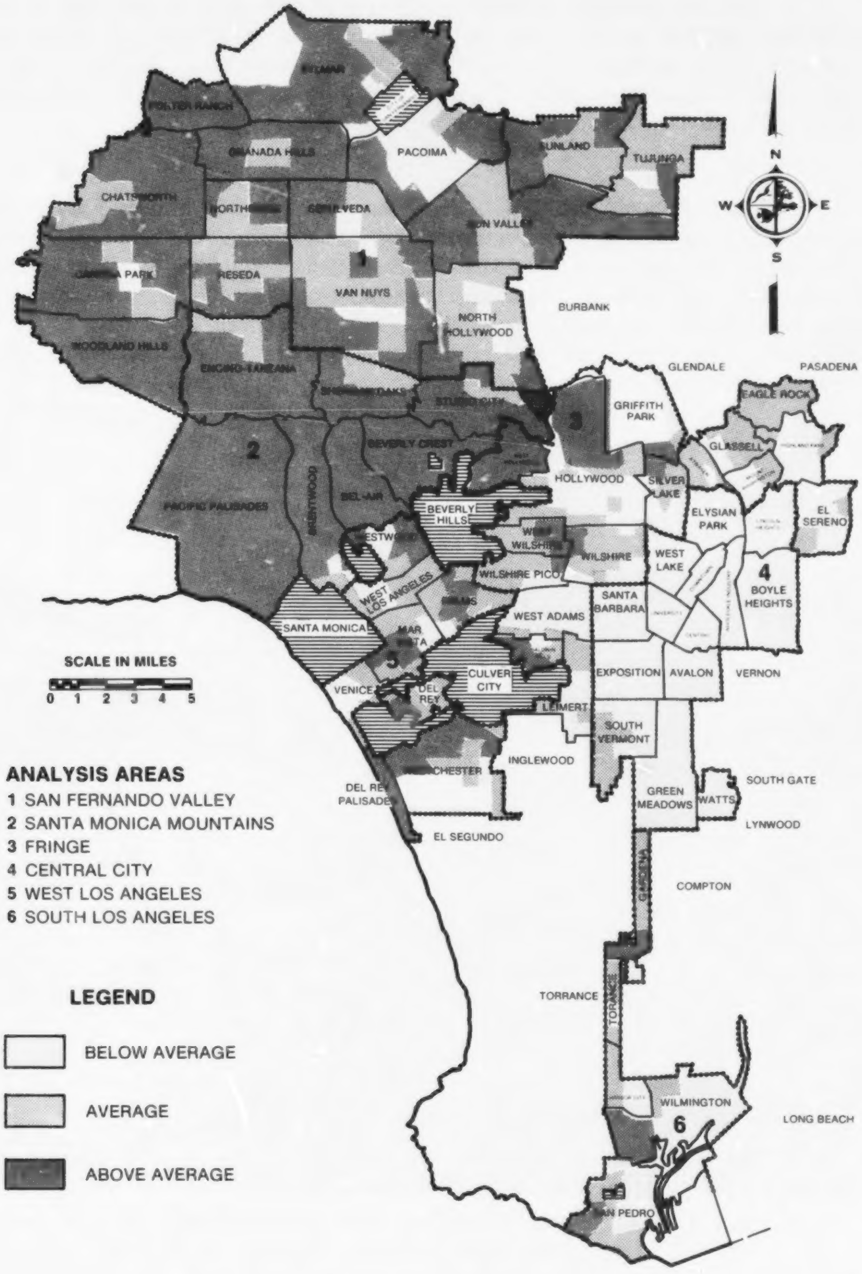
Table II-80. (continued).

THE SANTA MONICA MOUNTAINS							
COMMUNITY	MEDIAN FAMILY INCOME	MEDIAN HOME VALUES	DENSITY	NEIGHBORHOOD AMBIENCE RATING	EDUCATIONAL ACHIEVEMENT	HEALTH PRIORITY RANKING	OTHER COMMENTS
Bel Air	high	exclusive	low	above average	high	Excellent	Exclusively residential.
Beverly Crest	high	exclusive	low	above average	high	Excellent	
Brentwood	high	high to exclusive	low	above average	high	Excellent	Many apartments.
Encino-Tarzana	middle to high	low to exclusive	low to moderate	above average	average to high	Excellent	
Pacific Palisades	high	high to exclusive	low	above average	high	Excellent	Beach club area.
Sherman Oaks	middle to high	moderate to exclusive	low to moderate	above average	average to high	Excellent	Many apartments.
Studio City	middle high	moderate to exclusive	low to moderate	above average	average to high	Good	


PORTER
PACOIMA
BURBANK
GLENDALE
PASADENA
GRIFFITH PARK
N
W
E
S
HOLLYWOOD
BEVERLY HILLS
ELYSIAN PARK
WEST LAKE
4
BOYLE HEIGHTS
SANTA BARBARA
WEST ADAMS
SANTA MONICA
VENICE
CULVER CITY
EXPOSITION
AVALON
VERNON
SOUTH VERMONT
INGLEWOOD
DEL REY PALISADES
WESTCHESTER
EL SEGUNDO
GREEN MEADOWS
WATTS
SOUTH GATE
LYNWOOD
COMPTON
TORRANCE
WILMINGTON
6
LONG BEACH
SAN PEDRO
SCALE IN MILES
0 1 2 3 4 5
ANALYSIS AREAS
1 SAN FERNANDO VALLEY
2 SANTA MONICA MOUNTAINS
3 FRINGE
4 CENTRAL CITY
5 WEST LOS ANGELES
6 SOUTH LOS ANGELES
LEGEND
LESS THAN $7500
$7500 $10500
$10500 $15000
OVER $15000
CITYWIDE MEDIAN $10,535

198P-207

Figure II-145. Median family income increase in 1970 dollars (City of Los Angeles Community Analysis Bureau).



SYLMAR
PORTER RANCH
GRANADA HILLS
PACOIMA
SUNLAND
TUJUNGA
CHATSWORTH
NORTHRIDGE
SEPULVEDA
SUN VALLEY
CANOGA PARK
RESEDA
1
VAN NUYS
NORTH HOLLYWOOD
BURBANK
WOODLAND HILLS
ENCINO-TARZANA
SHERMAN OAKS
STUDIO CITY
GLENDALE
PASADENA
EAGLE ROCK
GRIFFITH PARK
3
GLASSELL
HIGHLAND PARK
2
BEVERLY CREST
PACIFIC PALISADES
BRENTWOOD
BEL-AIR
HOLLYWOOD
SILVER LAKE
ELYSIAN PARK
EL SERENO
BEVERLY HILLS
WESTWOOD
WEST WILSHIRE
WILSHIRE
WEST LAKE
4
BOYLE HEIGHTS
WILSHIRE PICO
WEST LOS ANGELES
SANTA BARBARA
WEST ADAMS
SANTA MONICA
MAR VISTA
5
CULVER CITY
EXPOSITION
AVALON
VERNON
VENICE
DEL REY
LEIMERT
SOUTH VERMONT
INGLEWOOD
WESTCHESTER
DEL REY PALISADES
GREEN MEADOWS
WATTS
SOUTH GATE
LYNWOOD
EL SEGUNDO
GARDENA
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TORRANCE
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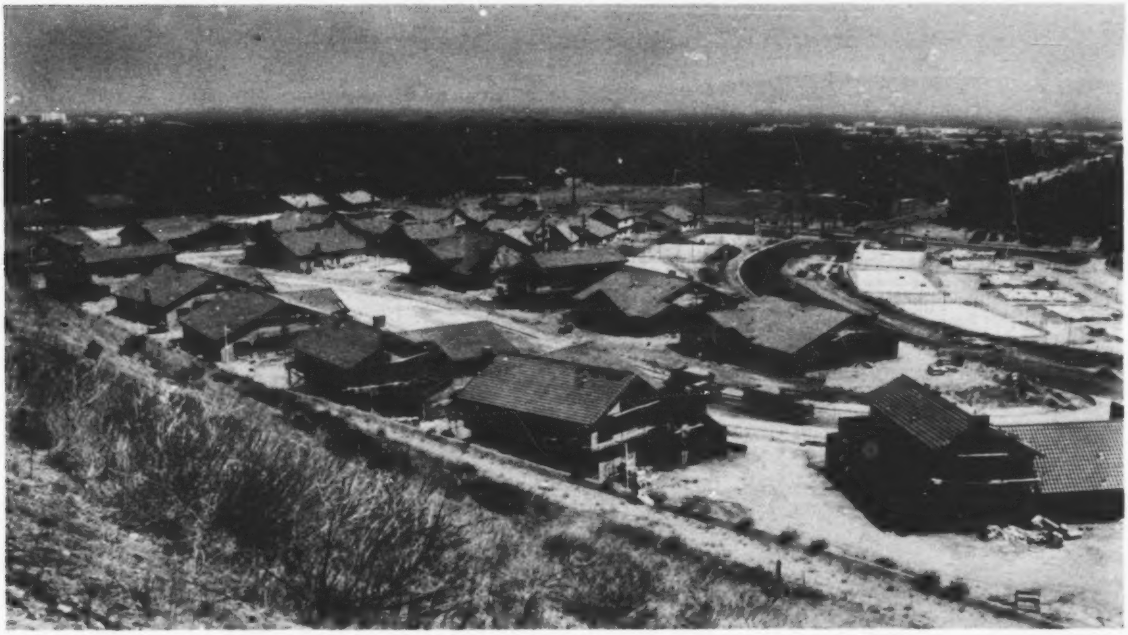
ANALYSIS AREAS
1 SAN FERNANDO VALLEY
2 SANTA MONICA MOUNTAINS
3 FRINGE
4 CENTRAL CITY
5 WEST LOS ANGELES
6 SOUTH LOS ANGELES
LEGEND
BELOW AVERAGE
AVERAGE
ABOVE AVERAGE

198P-208

Figure II-146. Median home values in 1970 dollars (City of Los Angeles Community Analysis Bureau).

(1) MEDIAN FAMILY INCOME. The range of median family incomes for individual census tracts was determined from 1970 census data with dollar amounts in 1970 dollars (Figure II-145) (Community Analysis Bureau, 1975e). 1970 median family income for the City was $10,535 in 1970 dollars (Community Analysis Bureau, 1974).

(2) MEDIAN HOME VALUES. The range of home values for owner-occupied, single-family homes was determined by census tract from 1970 census data (see Figures II-146 and II-147). The range of 1970 dollar values within the community is given. Low indicates a median value under $20,000. Moderate values were $20,000 to $35,000. High values ranged from $35,000 to $50,000. Values over $50,000 were considered exclusive. (Community Analysis Bureau 1975f). 1970 median value for single-family, owner-occupied homes in the City was $26,700 (Community Analysis Bureau, 1974; all figures in 1970 dollars).



198P-209

Figure II-147. New homes in the northwestern end of the San Fernando Valley. Since 1970, home values have increased by 50 to over 150 percent in current dollars.

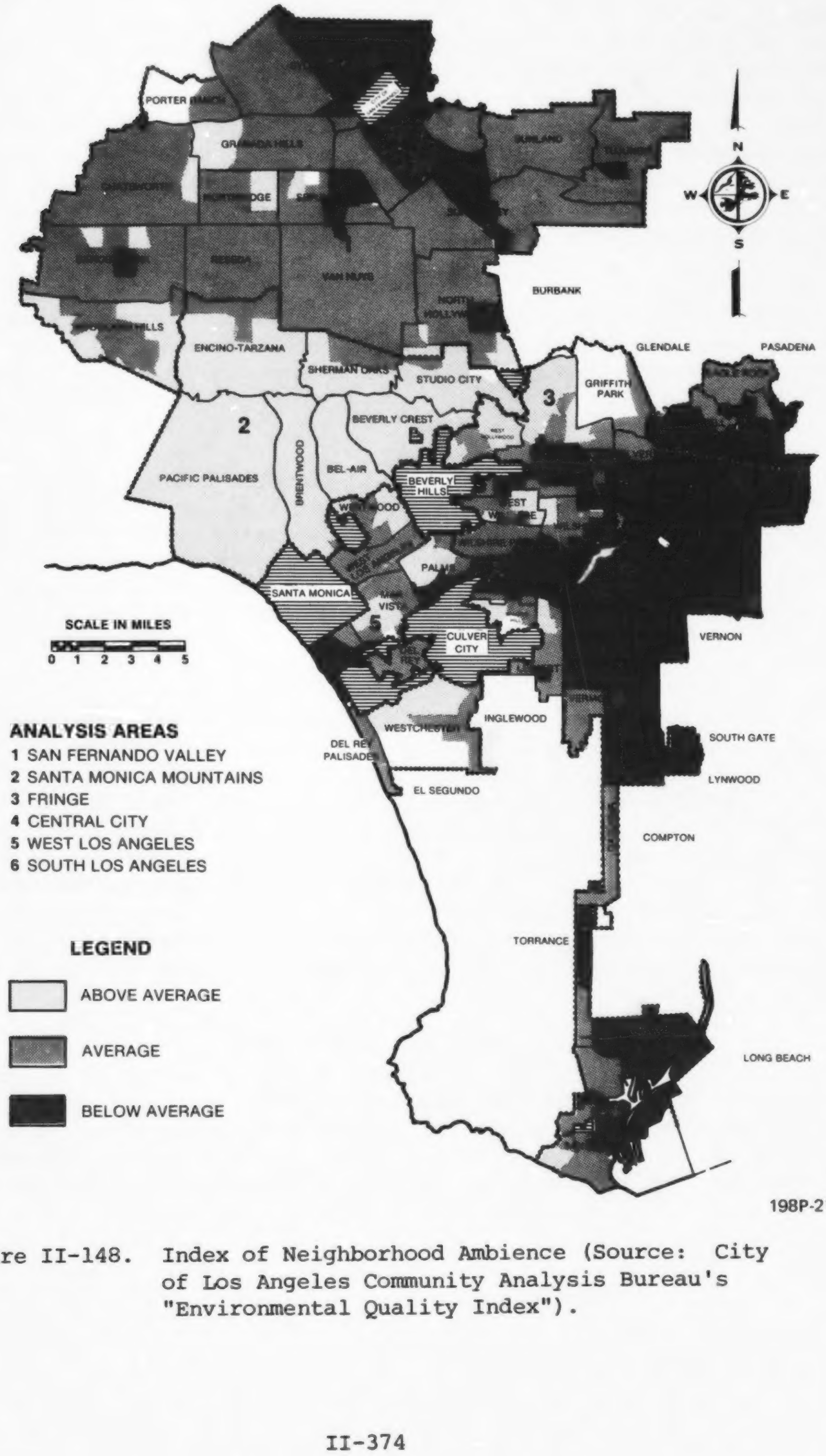
(3) OVERALL HEALTH. Overall community health criteria included narcotic arrest; cases of hepatitis, tuberculosis, gonorrhea, syphillis, and childhood disease; prenatal care indicators; suicides; percent families in poverty; percent population over 25 who have not completed high school; median family income; and the death rate for persons aged 25-44. Four categories were broken out: "Poor" identifies communities with the most health problems containing those tracts which have the greatest need for improvement of health programs; "Excellent" is the group of communities with the fewest problems; "Fair" and "Good" have intermediate priority (Community Analysis Bureau, 1975e).

(4) POPULATION DENSITY. A determination of community population density was made from maps indicating concentration of population in 1970 (Western Economic Research Co., 1971) and census tract data (Bureau of the Census, 1971).

(5) INDEX OF NEIGHBORHOOD AMBIENCE. The index is based on the more detailed "Environmental Quality Rates" of the Community Analysis Bureau (Figure II-148). The EQR was based on infrared aerial survey of the City. The analysis considered landscaping, litter, vacant lots, street conditions, convenience features, land use, lot use, dwelling types, dwelling size, and housing quality (see Figure II-149) (Community Analysis Bureau, 1975a).

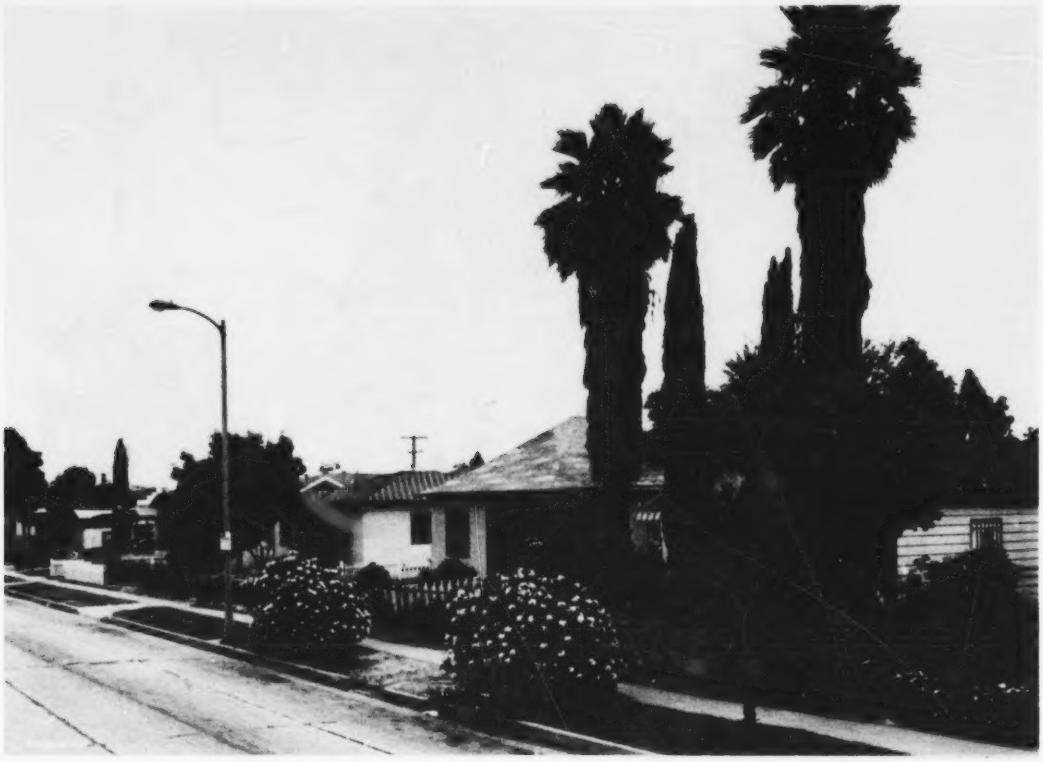
(6) EDUCATIONAL ACHIEVEMENT. The Community Analysis Bureau used eight variables to provide a composite educational achievement ranking. The eight variables selected for their impact on educational achievement are: percent households with rent/income greater than 25 percent; percent families with female heads; percent renter-occupied dwellings with 1.51+ persons per room; school year transiency rate out; and median sixth grade reading score. Communities at similar rankings were initially clustered as high, average, transitional, and low (or priority). For this environmental impact statement the transitional and average groups have been combined (Figure II-150) (Community Analysis Bureau, 1975d).

(7) OTHER FACTORS. Many other variables contribute to the quality or flavor of a particular community, but are of little or no relevance to others. For example, Los Angeles International Airport has a unique effect on proximal areas but not on most other locations. Where unique aspects are appropriate, they are noted. Included are kinds and presence of industry, types of dwelling units, ethnic diversity and age distribution.


N
W
E
S
PORTER RANCH
GRANADA HILLS
CHATSWORTH
NORTHRIDGE
SUNLAND
TUJUNGA
RESEDA
VAN NUYS
NORTH HOLLYWOOD
BURBANK
WOODLAND HILLS
ENCINO-TARZANA
SHERMAN OAKS
STUDIO CITY
GLENDALE
PASADENA
EAGLE ROCK
GRIFFITH PARK
2
3
PACIFIC PALISADES
BRENTWOOD
BEVERLY CREST
BEL-AIR
BEVERLY HILLS
WESTWOOD
WEST LOS ANGELES
PALMS
SANTA MONICA
MAR VISTA
5
CULVER CITY
VERNON
SCALE IN MILES
0 1 2 3 4 5
INGLEWOOD
WESTCHESTER
DEL REY PALISADES
EL SEGUNDO
SOUTH GATE
LYNWOOD
COMPTON
TORRANCE
LONG BEACH
ANALYSIS AREAS
1 SAN FERNANDO VALLEY
2 SANTA MONICA MOUNTAINS
3 FRINGE
4 CENTRAL CITY
5 WEST LOS ANGELES
6 SOUTH LOS ANGELES
LEGEND
ABOVE AVERAGE
AVERAGE
BELOW AVERAGE

198P-210

Figure II-148. Index of Neighborhood Ambience (Source: City of Los Angeles Community Analysis Bureau's "Environmental Quality Index").



198P-211

Figure II-149. The index of Neighborhood Ambience considered variables including landscaping, street conditions, and housing quality. This area in Watts was ranked below City average.

b. Environmental Quality for Specific Communities. It is impossible to capture the wide diversity of a major metropolitan area such as Los Angeles if the discussion focuses on large geographic areas. Contrary to popular myths, the San Fernando Valley is not a homogeneous mass of middle-class, single-family homes, inhabited exclusively by white families with two children and two cars. Stereotypes for other areas of the city are equally inappropriate. To capture the great diversity of Los Angeles the following subsections detail each of the 65 Community Analysis Bureau's planning areas but for convenience these areas have been grouped into 6 main divisions: the San Fernando Valley; the Santa Monica Mountains; the Fringe; the Central City; West Los Angeles; and South Los Angeles.

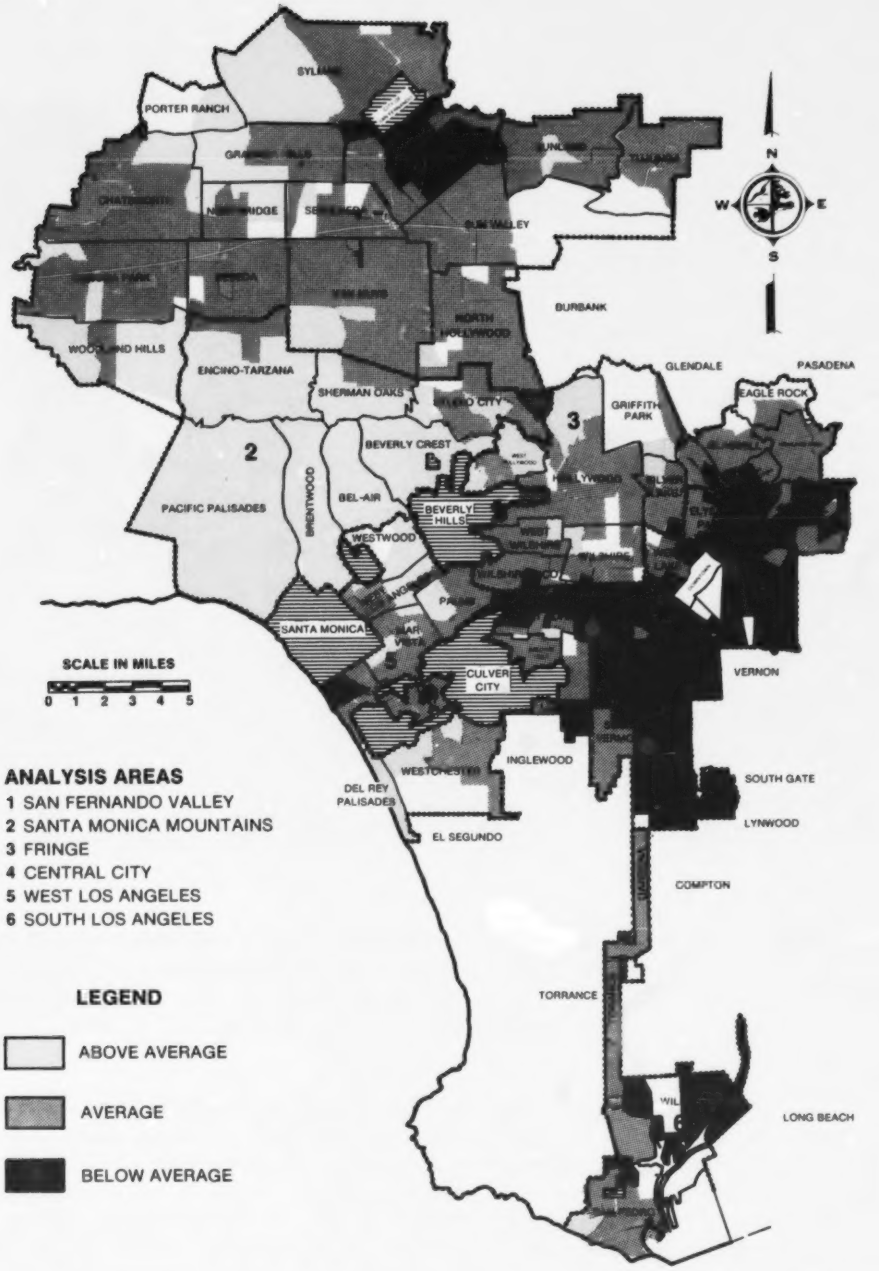

PORTER RANCH
SYLMAR
SUNLAND
TUJUNGA
CHATSWORTH
NORTHRIDGE
SUN VALLEY
N
W
E
S
BURBANK
NORTH HOLLYWOOD
WOODLAND HILLS
ENCINO-TARZANA
SHERMAN OAKS
GLENDALE
PASADENA
EAGLE ROCK
GRIFFITH PARK
2
3
BEVERLY CREST
PACIFIC PALISADES
BRENTWOOD
BEL-AIR
BEVERLY HILLS
WESTWOOD
HOLLYWOOD
WEST WILSHIRE
SANTA MONICA
MAR VISTA
CULVER CITY
VERNON
SCALE IN MILES
0 1 2 3 4 5
INGLEWOOD
WESTCHESTER
DEL REY PALISADES
SOUTH GATE
LYNWOOD
EL SEGUNDO
COMPTON
TORRANCE
LONG BEACH
SAN PEDRO
ANALYSIS AREAS
1 SAN FERNANDO VALLEY
2 SANTA MONICA MOUNTAINS
3 FRINGE
4 CENTRAL CITY
5 WEST LOS ANGELES
6 SOUTH LOS ANGELES
LEGEND
ABOVE AVERAGE
AVERAGE
BELOW AVERAGE

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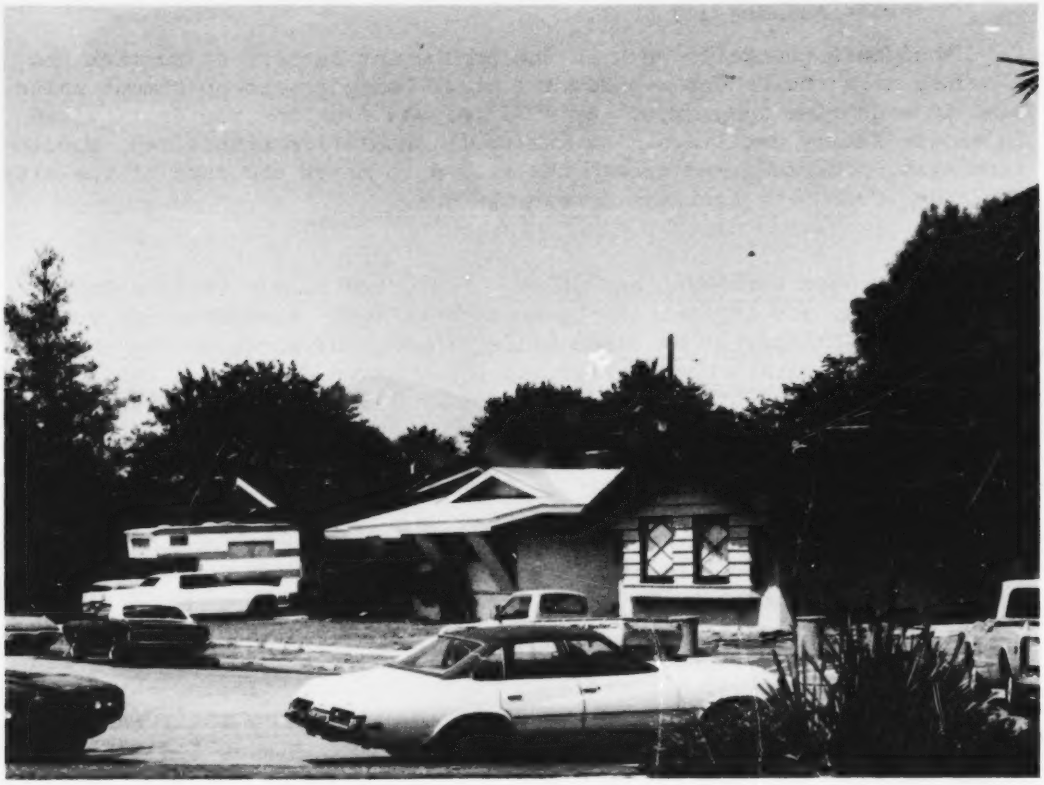
Figure II-150. 1970 Educational Achievement (Source: City of Los Angeles Community Analysis Bureau).

(1) SAN FERNANDO VALLEY. The San Fernando Valley forms a largely suburban complex with above-average living standards. Despite pockets of lower income, there are a few places in America where so many people live in comparable affluence. (Lantis, Steiner, and Kerinen, 1973). Residential development of the Valley has chiefly occurred since 1940 with the largest percentage of the City's new residents in the last three decades settling in the Valley (see Figure II-151). Most of the land developed during this time had previously been in agricultural use. Growth patterns were classic; paralleling old major roadways and in areas near connectors. Young families attracted by citywide economic expansion found the Valley's increased home construction and improved transportation to be a desirable suburban location. Mid 1950s development of aerospace and electronics industry reduced the Valley's dependence on employment markets



198P-213

Figure II-151. Single-family dwellings such as these in Northridge spread throughout the San Fernando Valley in the 1950s and 1960s.

in other areas of the Los Angeles Basin and continued the economic expansion in the 60s. In the 1970s, community maturity, slower inmigration and decreased birth rates effectively tapered growth. Only the outlying communities of Canoga Park, Chatsworth, Porter Ranch, Sylmar, and Woodland Hills had the available space within which to sustain continued development. (Community Analysis Bureau, 1975b).

(a) North Hollywood. North Hollywood was one of the first communities settled in the Valley and is also the most easily accessed portion of the Valley to the trans-mountain Los Angeles Civic Center. During the 1940s many young, professional, white-collar workers were attracted to newly constructed single-family homes and low density apartments. North Hollywood remains above citywide norms in terms of income, home values, neighborhood ambience and health.

Residents generally work in the employment centers of Burbank and Glendale with the recent residential trend being toward apartment units, some in high-rise complexes. By 1970 only half of the residents lived in single-family dwellings. As the youth population stabilized, population aging occurred, and growth has slowed to match the rate of the city at large (Community Analysis Bureau, 1975b).

(b) Canoga Park-Woodland Hills. These two communities, a City Planning area, are typical of the Western Valley. Residents are young, usually with families. Woodland Hills, in many ways resembling the Santa Monica Mountain communities, is somewhat more affluent than Canoga Park, although both offer high standards of living. Incomes ranged in 1970 from moderate ($7,500 to $10,000) to high (over $15,000) in Canoga Park; and from middle ($10,000 to $15,000) to high (over $15,000) in Woodland Hills, (Community Analysis Bureau, 1975e). Home values show a similar pattern with some exclusive housing (over $50,000) in Woodland Hills. Density is low in Woodland Hills, and low to moderate in Canoga Park and neighborhood ambience is above average in both. Educational achievement is average to high in Canoga Park, and high in Woodland Hills. Twenty-three percent of the residents over 25 in Canoga Park and 33 percent of the residents of Woodland Hills have complete college compared to citywide norms of 13 percent (see Figure II-152). Employment is chiefly white-collar with many professionals (Community Analysis Bureau, 1975b). Both communities have better than average health ratings (Community Analysis Bureau, 1975c).

Canoga Park and Woodland Hills were still experiencing growth in the late 60s. New single-family residential neighborhoods were being developed. In Canoga Park apartment units were also increasing in importance. Rented units, mostly apartment units, now account for approximately 34 percent of the housing supply (Community Analysis Bureau, 1975b).

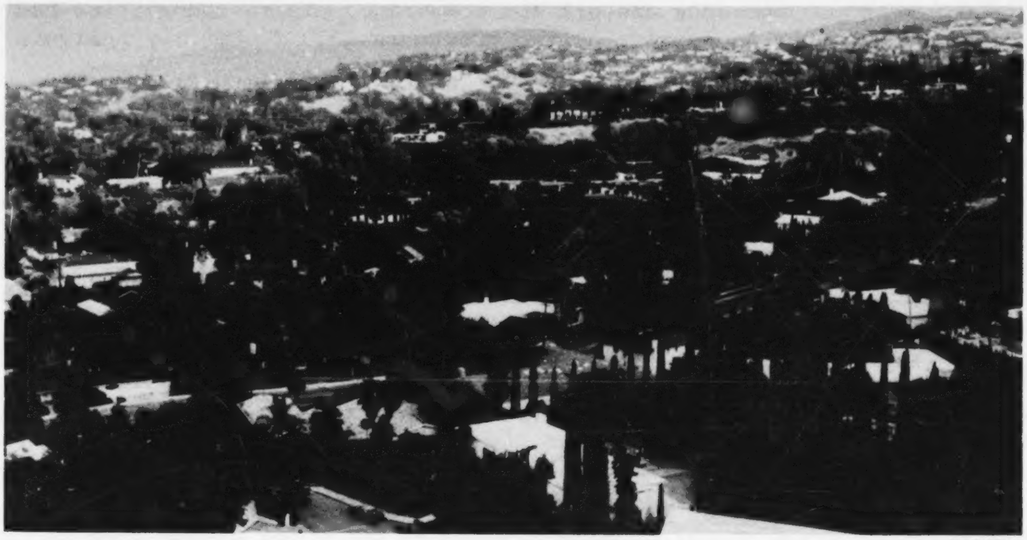

198P-214

Figure II-152. Woodland Hills in the southwestern San Fernando Valley has low density, high neighborhood ambience, and 33 percent of the residents have a college education.

(c) Granada Hills - Northridge. These two communities comprised a City Planning Area with middle to high median family incomes in 1970 (Community Analysis Bureau, 1975e). Home values likewise ranged from middle ($20,000 to $35,000) to exclusive (over $50,000) (Community Analysis Bureau, 1975f). Density is low to moderate and ambience is above average (Community Analysis Bureau, 1975a). Educational achievement, typical for an affluent community, is average to well above average for the City (Community Analysis Bureau, 1975d). Twenty-two percent of the Granada Hills' residents over 25, and 30 percent of those in Northridge have completed college (Community Analysis Bureau, 1975b). This planning area has considerably better than average health rankings (Community Analysis Bureau, 1975c). Both communities are primarily single-family, owner-occupied communities although apartments were the major type of new construction in the 60s (Community Analysis Bureau, 1975b). A California State University is located in Northridge.

(d) Chatsworth - Porter Ranch. This planning area, lying on the outer edges of the valley, was developed in the late 50s and early 60s concurrent with the construction of three freeways (Golden State, Ventura, and San Diego). The life style, as in the rest of the Western Valley, is determined by the young to middle aged affluent residents (Lantis, Steiner & Kariner, 1973). Income home values, educational achievement and neighborhood ambience are all above average. These communities had parcels and zoning to sustain active growth in 1970 (Community Analysis Bureau, 1975b).

(e) Van Nuys - Reseda. The Van Nuys - Reseda area developed during the 1950s with the siting of industry and aerospace firms in the area (Community Analysis Bureau, 1975b). Median income in 1970 for various census tracts ranged from moderate ($7,500 to $10,000) to high (over $15,000) (Community Analysis Bureau, 1975e). 1970 home values were middle in Reseda (20,000 to $35,000) and varied from low (under $20,000) to high ($35,000 to $50,000) in Van Nuys (Community Analysis Bureau, 1975a). Educational achievement is average to high in Van Nuys, and closer to citywide averages in Reseda, which has more working class families than most of the Valley (Community Analysis Bureau, 1975d). Reseda and Van Nuys are somewhat above average in the health rating (Community Analysis Bureau, 1975c).

Reseda and Van Nuys experienced their most extensive expansion during the fifties. In the sixties growth began to match the slowed rate of the City at large. Population aging and an increase in apartment structures typified the decade. By 1970 half of the housing units in Van Nuys were apartments. Reseda showed a shift toward rented single-family homes that is characteristic of older central city communities (Community Analysis Bureau, 1975b).

(f) Pacoima. Family incomes in 1970 were generally below the citywide median (Community Analysis Bureau, 1975e) and home values were likewise lower (Western Economic Research Co., 1971). Density is moderate to high and neighborhood ambience ratings are the lowest in the Valley. Educational achievement is low to average with only 8 percent of the residents over 25 having completed college (Community Analysis Bureau, 1975d). Over-all health rankings placed most of Pacoima in the health planning area of greatest need. Pacoima is the only Valley community with a predominantly minority population (53 percent of all residents in 1970) (Community Analysis Bureau, 1975b).

During the fifties, Pacoima was a target area for a federally subsidized housing project which assisted moderate income families in the purchase of single-family homes. Both rent and housing values remained low, but the percentage of owner-occupied homes moved from 63 percent in 1950 to 80 percent in 1960. The sixties were marked by some apartment construction and population maturation.

(g) Sun Valley - Sunland - Tujunga. The Northeast Valley living conditions are generally above average for the City, although they do not match the high standard of living found in the western part of the Valley. Income ranged from moderate to high (Community Analysis Bureau, 1975e). Median home values had considerable variety from moderate to high (Community Analysis Bureau, 1975e). Median home values had considerable variety from census tract to census tract. Educational achievement is average in most tracts although high in parts of Sun Valley (Community Analysis

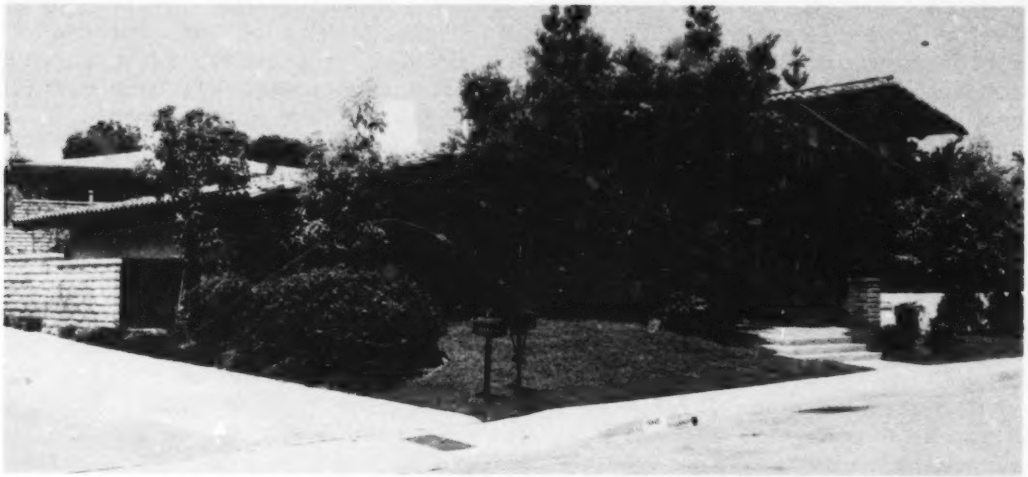
Bureau, 1975d). The planning area, comprised of these three communities, is a moderately low priority health zone (Community Analysis Bureau, 1975c).

(h) Sylmar. Sylmar has more variety in its socioeconomic environment than most Valley or City communities as is to be expected in a large community located between the less affluent Northeast Valley and more affluent West Valley. Median family incomes in 1970 ranged from moderate to high (Community Analysis Bureau, 1975e). 1970 median values for single-family, owner-occupied homes varied from low (under $20,000) to high ($35,000 to $50,000) (Western Economic Research Co., 1971). Population density is generally low. Neighborhood ambience and educational achievement vary from low to high, depending on the census tract involved (Community Analysis Bureau, 1975d). Sylmar is a moderately high priority health planning area that has relatively significant health needs, particularly for the Valley (Community Analysis Bureau, 1975c). In 1970, Sylmar still had some potential for development. There was a small trend toward multiple family units during the 1960-70 decade (Community Analysis Bureau, 1975b).

(i) Sepulveda. Sepulveda, like Sylmar, is a transition community between the affluent development in the Western Valley and the more "average" conditions of the Northestern Valley. Median family income in 1970 varied from moderate ($7,500 to $10,000) to high (over $15,000) (Community Analysis Bureau, 1975e). Home values were in the $20,000 to $35,000 range according to 1970 census figures (Western Economic Research Co., 1971). Density is low to moderate, and neighborhood ambience is rated as about average (Community Analysis Bureau, 1975d). The last major addition to single-family residential neighborhoods in Sepulveda occurred in the 1950s. During the 1960s apartment buildings became the major type of new construction.

(2) THE SANTA MONICA MOUNTAINS. The Santa Monica Mountains are the most exclusive residential section of the City. The highly desirable conditions found within the mountains attract and can be afforded by only upper-middle and higher income residents (see Figure II-153).

(a) Bel Air - Beverly Crest - Brentwood - Pacific Palisades. The yearly family income levels within these communities is consistently high (above $15,000). Home values are comparable with most houses valued at over $50,000 in 1970 (Community Analysis Bureau, 1975f). Many units are large, expensive homes built during the Hollywood heyday. Density is low with residences distributed over the mountainsides and in the numerous scenic canyons. Private swimming pools are common; approximately 20 percent of the parcels are undeveloped. Educational achievement is the highest in the City as might be anticipated in such an affluent area. The median sixth grade reading score is near 70, while 37 is the median for the City (Community Analysis Bureau, 1974). The City ranks these communities high in health characteristics (Community Analysis Bureau, 1975c). The population is nearly all white and white-collar or professionally employed. Almost all workers commute to jobs outside the planning areas. Bel Air - Beverly Crest - Brentwood - Pacific Palisades probably represent the highest mix of traditional "quality of life" attributes within the City of Los Angeles.



198P-215

Figure II-153. The Santa Monica Mountains have the most exclusive residential areas in the City on its north and south slopes. This residence is on the crest of Mulholland Drive.

(b) Encino - Tarzana - Sherman Oaks - Studio City. These planning areas are, to an extent, a "spill-over" of luxury homes found in the Santa Monica Mountain communities and a transitional area to Valley communities. The 1970 median income levels (over $15,000) and median home values ($50,000 and over) within census tracts located on the northern slopes of the mountains are high, but as one moves north into the Valley, income levels and home values, although still above city medians, drop somewhat.

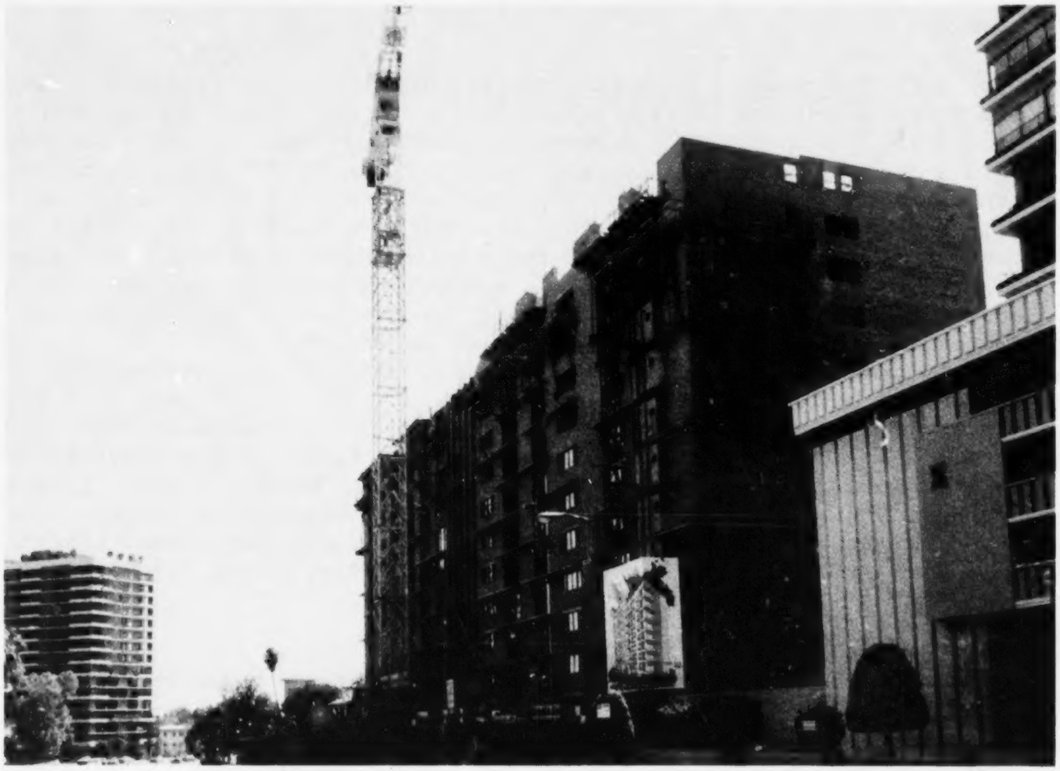
The Sherman Oaks - Studio City area was developed primarily in the 1940s. Both communities still contain a significant percentage of singles in apartments. Apartments are often expensive and clustered near freeways and arterials. Household sizes are small. Development in the Encino-Tarzana area came later, mainly in the 50s, and the area was more family-oriented (Community Analysis Bureau, 1975b). Neighborhood ambience follows the same south-north trend as income and housing values. Census tracts, to the south in the mountains have high ratings; tracts down in the Valley are nearer to the City average but still above average (Community Analysis Bureau, 1975a). Educational achievement likewise is highest in the mountains, and approaches average for the City out in the Valley (Community Analysis Bureau, 1975d). Neither area has significant health problems (Community Analysis Bureau, 1975c).

(3) THE FRINGE COMMUNITIES. The fringe communities are an area distinct from the innercity and from the suburban areas of the Santa Monica Mountains and the San Fernando Valley. The "fringe" is composed of a variety of highly diverse communities which are located between five and ten miles from downtown Los Angeles, and have conditions generally ranging from slightly above to slightly below average for the City (Community Analysis Bureau, 1975a). Residential development is intensive, with multiple family units mixed in among older, single family homes. Percentages of senior citizens and minority residents are among the highest in the City (Community Analysis Bureau, 1975b).

(a) West Adams - Leimert - Baldwin Hills. Median family incomes in these communities in 1970 ranged from moderate ($7,500 to $10,500) to middle (10,500 to $15,000) (Community Analysis Bureau, 1975e). Housing values are mostly in the moderate range ($20,000 to $35,000), with some tracts in Leimert having 1970 values below $20,000, and some in Baldwin Hills having values over $35,000. All of the communities have relatively dense land use, although some of the more expensive tracts in the Baldwin Hills are sparsely developed. Neighborhood ambience ratings are from above to below average (Community Analysis Bureau, 1975a). Educational achievement is approximately average for Baldwin Hills but below average in some tracts of Leimert and West Adams (Community Analysis Bureau, 1975d). Statistics indicate that all these communities have some needs with most tracts in the moderately high health priority area (Community Analysis Bureau, 1975c). These three communities have sizable black populations in the moderate income range (Community Analysis Bureau, 1974). Leimert and West Adams, particularly, are transitional communities between the innercity and the fringe with improving housing and educational trends dependent on future economic developments (Community Analysis Bureau, 1975f).

(b) Wilshire - West Wilshire - Wilshire Pico. These three communities are characteristically apartment communities consisting of young, single working residents, and mature, retired residents. 1970 median family incomes were moderate to middle ($7,500 to $15,000) in Wilshire-West Pico; high (over $15,000) in Wilshire; and low to high in West Wilshire. A sizable percentage (42 percent) of West Wilshire residents are over 60 years of age and some are on low, fixed incomes while others are living on substantial past earnings (Community Analysis Bureau, 1975e). Values of single-family homes in 1970 were generally moderate to high

($20,000 to $50,000) although two tracts in Wilshire have median values under $20,000. Other tracts in Wilshire and West Wilshire had median home values of over $50,000 (Western Economic Research Company, 1971). Population density is moderate to high while neighborhood ambience ranges from above to below average (Community Analysis Bureau, 1975a). Educational achievement generally is near the citywide average (Community Analysis Bureau, 1975d). Seventeen percent of Wilshire residents over 25 have completed college; 12 percent of Wilshire-West Pico's; and 14 percent of West Wilshire's population (Community Analysis Bureau, 1975b). Wilshire-West Pico is a moderately high health priority area with some health needs. Wilshire is moderately low and West Wilsire is low. This area includes the "Miracle Mile" job centers, and is readily accessible to downtown employment. Public transportation is important to young working people and mature retired people without automobiles (Figure II-154) (Community Analysis Bureau, 1975g).



198P-216

Figure II-154. The Wilshire area has apartment communities that meet the needs of both the young, single working residents and the mature retired residents.

(c) Hollywood - West Hollywood - Griffith Park. This area, originally the focus of the entertainment industry, is still an attractive residential center. Median family income is generally high with some moderate income tracts in Hollywood and Griffith Park and some low tracts in older areas of Hollywood (Community Analysis Bureau, 1975e). Median home values also are variable with high cost ($20,000 to $35,000) and exclusive (over $50,000) tracts found in all three. Generally homes are older, but expensive. Exclusive high-rise apartments have been developed over the years, particularly in Hollywood along major transportation and commercial strips (Community Analysis Bureau, 1975b). Population density in these areas is high but elsewhere low or moderate. Educational achievement approximates citywide averages with some higher achievement in West Hollywood (Community Analysis Bureau, 1975b). All three communities are moderately high health priority areas. (Community Analysis Bureau, 1975d). Nearby Griffith Park provides recreational opportunities.

(d) El Sereno. El Sereno is an older, family-oriented community that experienced a major population growth of minority families, primarily Spanish language or surname, during the 60s. By 1970, El Sereno was 79 percent non-Anglo (Community Analysis Bureau, 1975b). Median family income ranges approximate city averages (Community Analysis Bureau, 1975e). Median home values are generally below $20,000 in one-half of the tracts and in the $20,000 to $35,000 range in the rest of the community (Western Economic Research Co., 1971). Neighborhood ambience is below average (Community Analysis Bureau, 1975a). Educational achievement is below the City median. Median sixth grade reading score for several census tracts is approximately 24. The City median is 37. An estimated 4 percent of the residents over 25 have completed college (Community Analysis Bureau, 1975d). Health statistics place El Sereno in the moderately high priority area for the city. The population is young with 44 percent under 19, and 46 percent in the 20-59 age bracket (Community Analysis Bureau, 1974). Socioeconomic parameters place El Sereno below average for the City, but poverty conditions are uncommon in this community.

(e) Silver Lake - Atwater - Glassell - Eagle Rock. These communities are part of the Northeast Los Angeles planning area and have average numberings slightly below average rankings for the overall city in most of the socioeconomic categories. Ethnic diversity, occurs to downtown, and a mixture of dwelling unit types are characteristic of the area.

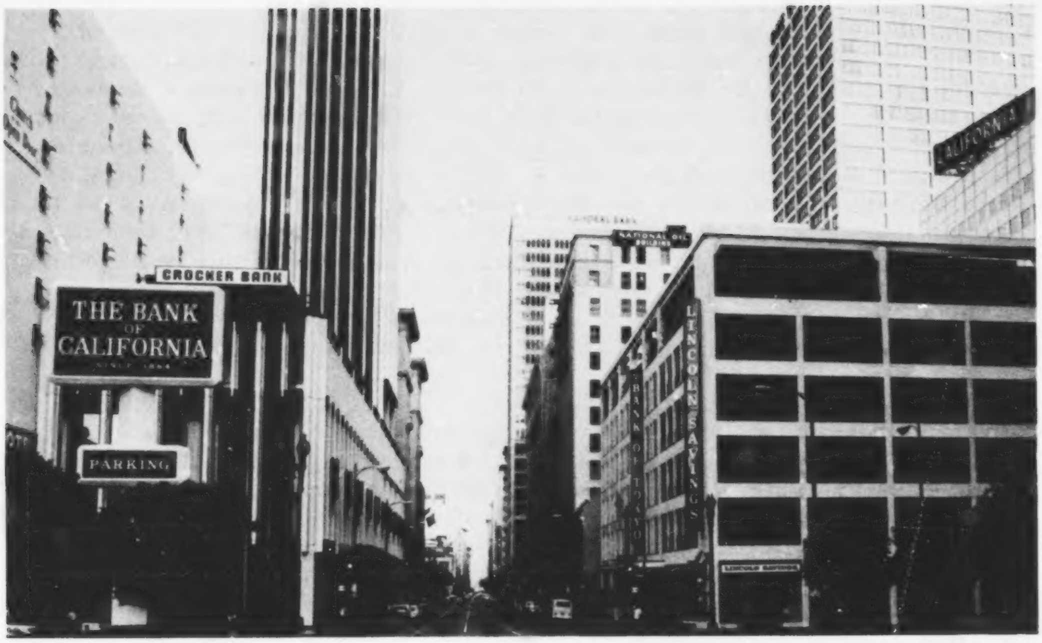
Median family incomes in individual census tracts in 1970 ranged from $7,500 to $15,000. The city median is $10,535 (Community Analysis Bureau, 1975e). Median home values were mostly under $20,000 with some in the $20,000 to $35,000 range. A few tracts in Silver Lake had high median values ($35,000 to to $50,000). Density is low to moderate.

Neighborhood ambience ratings are mostly near average in Glassell, Silver Lake, and Eagle Rock with few tracts in Silver Lake and all of Atwater being below average (Community Analysis Bureau, 1975a). Some tracts in Atwater and Silver Lake had below average educational rankings in 1970. These tracts were included in the City's educational priority group (Community Analysis Bureau, 1975d). Health designations for the area vary. Atwater and Silver Lake are in the moderately low priority area and Eagle Rock and Glassell in the moderately high priority area (Community Analysis Bureau, 1975c). There is a trend in the area toward rented dwellings and higher density residential development. Minority populations make up more than one-third of each of the communities except Eagle Rock.

(f) Highland Park - Mount Washington. These older communities, already well established in the 1940s, had growth in later years concentrated in the form of new apartment buildings. During the 50s the population shifted with new minority residents and young families replacing older white residents who emigrated (Community Analysis Bureau, 1975a). Incomes in the area approximate citywide averages ranging from $7,500 to $15,000 (Community Analysis Bureau, 1975e). Median home values vary from low (under $20,000) to moderate (20,000 to $35,000). Density is moderate. Neighborhood ambience is generally below average (Community Analysis Bureau, 1975a). Educational achievement is near average for the City in Highland Park, and average to below average in Mount Washington census tracts (Community Analysis Bureau, 1975d). Both communities are in the moderately high health priority group (Community Analysis Bureau, 1975c). Mount Washington has a 61 percent minority population. Highland Park has 33 percent minority residents (Community Analysis Bureau, 1975b).

(4) THE CENTRAL CITY. The Central City reached its peak population in the 1940s. During the 1950-1970 time period, Anglo migration resulted in a population loss that has partly been offset by migration of minority residents. The downtown area diminished somewhat in importance as other commercial and employment "centers" of city activity developed. The Central City today has the highest percentages of senior citizens and minority residents, and the largest inventory of inexpensive and overcrowded housing units (Community Analysis Bureau, 1975b).

The Central Business District (CBD) (Figure II-155) has an estimated 300,000 jobs, approximately 20 percent of the total employment in the City. Although it is by far the single largest job center, it has a relatively small percentage of the total employment in the metropolitan area. Completion of a performing arts center and downtown high-rise office buildings have done much to revitalize the CBD. Central residential neighborhoods, however, affected over the years by freeway construction, an aging housing supply, and urban pollution have contributed to a decline in "quality of life" (Community Analysis Bureau, 1975e).



198P-217

Figure II-155. Redevelopment in the Central Business District with high-rise office buildings has created room for expansion of office and financial institution employment opportunities.

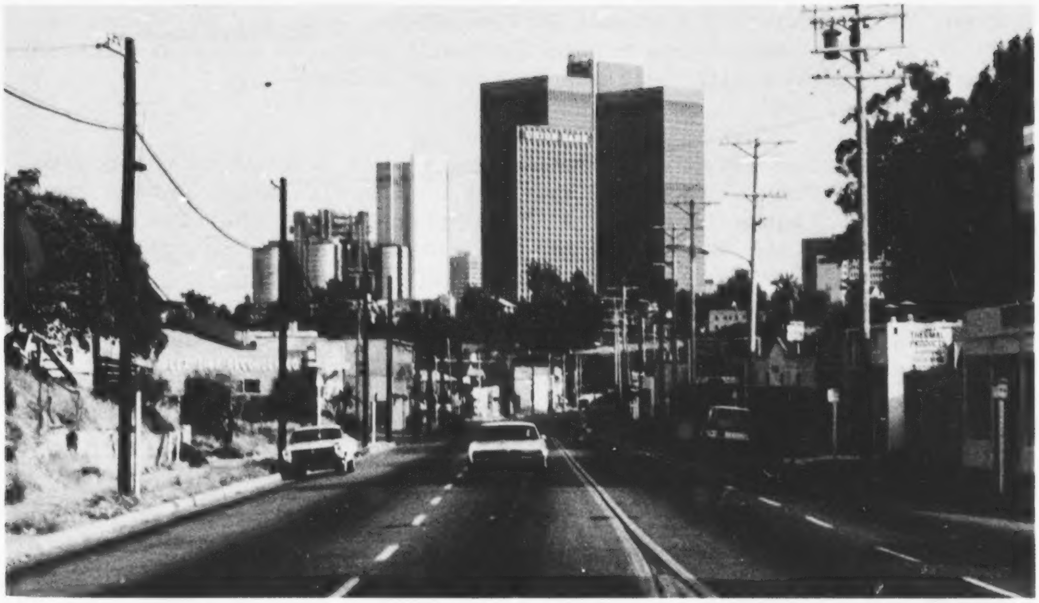
(a) Avalon - Green Meadows - Watts. These three communities comprise the Southeast Los Angeles planning area. Originally, single-family homes dominated the area, but since 1950, multiple family dwelling expansion has occurred. Watts is the City's oldest predominantly minority community, Avalon and Green Meadows became minority communities during the 1940s. Today each is over 95 percent minority, primarily black. Median family incomes were under $7,500 in 1970 in Avalon and Watts. Income in Green Meadows was slightly higher, generally $7,500 to $10,000 (Community Analysis Bureau, 1975e).

Median home values were low (under $20,000) in all three communities (Western Economic Research Co., 1971), and population density is high. Neighborhood ambience is low throughout the area (Community Analysis Bureau, 1975a), and the entire area is included in the City's highest health need priority area (Community Analysis Bureau, 1975c).

(b) Santa Barbara - Exposition - South Vermont. These communities are included in the City's South Central planning area. Median family incomes in 1970 ranged from low (under $7,500) to middle (10,500 to $15,000) (Community Analysis Bureau, 1975e), and home values varied from low (under $20,000) to moderate ($20,000 to $35,000) (Western Economic Research Co., 1971). Density is high in Santa Barbara and Exposition, somewhat lower in South Vermont, which has more of an open residential character. Neighborhood ambience is below average in Exposition and Santa Barbara and mixed in the more economically mixed community of South Vermont (Community Analysis Bureau, 1975a). Educational achievement is low in most census tracts of Santa Barbara and Exposition. South Vermont's educational statistics are closer to the City's averages (Community Analysis Bureau, 1975d). Most of the area is grouped in the City's highest health priority area (Community Analysis Bureau, 1975c).

(c) West Lake - University - Central. These three communities bordering the downtown area have had industrial and commercial expansion with their character changed from residential to crowded mixed urban. Median family income for census tracts in this area in 1970 were low (under $7,500) (Community Analysis Bureau, 1975e). Home values ranged from low (under $20,000) to moderate ($20,000 to $35,000) (Community Analysis Bureau, 1975f). Population density in residential area is high. The City's Community Analysis Bureau rated neighborhood ambience as very low (Community Analysis Bureau 1975a). Educational achievement is low throughout most of the area with fewer than 4 percent of the population over 25 having completed college and median sixth grade reading scores of 20 or below for most census tracts (Community Analysis Bureau, 1975d). The area ranks low in health statistics and is included in the City's highest health priority group (Community Analysis Bureau, 1975c). All three communities have large minority, both black and Spanish surname populations (Community Analysis Bureau, 1975b).

(d) Downtown - Wholesale Industry. This area is a major job center of Los Angeles, and consequently has relatively few residents. Most of the area has been converted to industrial and commercial development with some remaining multiple family dwellings (see Figure II-156). Median family incomes in 1970 for the area were low (under $7,500) (Community Analysis Bureau, 1975). Because of the low number of owner-occupied single-family dwellings, median home values have not been calculated for most census tracts although the downtown district does include one tract of exclusive (over $50,000) housing (Western Economic Research Co., 1971). Average population density is low although those areas containing residents are densely populated. The Downtown - Wholesale Industry area is included in the City's highest health priority area and leads the City in cases of syphillis, tuberculosis, and narcotics arrests.



198P-218

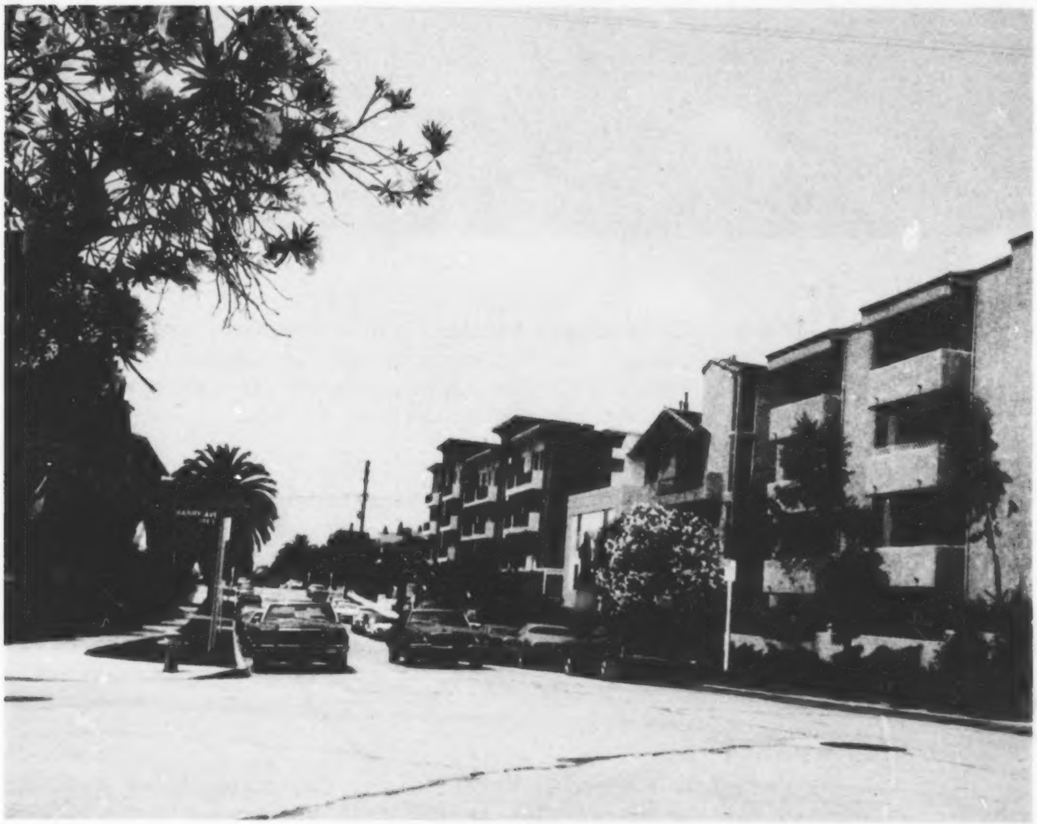
Figure II-156. Communities bordering the downtown area have had industrial and commercial development overlaid on older multiple family residential to produce a crowded, mixed urban environment.

(e) Boyle Heights. Originally a choice residential district, Boyle Heights now has the problem of the innercity. Median family incomes for 1970 were generally below $10,500 (Community Analysis Bureau, 1975e). Median home values were under $20,000 (Western Economic Research Co., 1971). Density is high; neighborhood ambience is rated below average. Educational achievement is also low (Community Analysis Bureau, 1975d). Boyle Heights is included in the City's top health priority area (Community Analysis Bureau, 1975c).

(f) Lincoln Heights - Elysian Park. These two communities are very similar. Both had low (under $7,500) median family incomes in 1970 (Community Analysis Bureau, 1975e). Home values were low (under $20,000) to moderate ($20,000 to $35,000) and population density is moderate. Neighborhood ambience ratings are below the City average (Community Analysis Bureau, 1975a). Educational achievement is low for all census tracts (Community Analysis Bureau, 1975d). Minority residents comprise more than 50 percent of the population in both Elysian Park and Lincoln Heights. Lincoln Heights has a high proportion of Spanish surname residents, whereas Elysian Park has a mixed ethnic character (Community Analysis

Bureau, 1974; Community Analysis Bureau, 1975b). In the 60s there was a shift in both communities toward apartment units as older single-family homes were replaced with multiple family dwellings.

(5) WEST LOS ANGELES. West Los Angeles is located on the coastal plain south of Sunset Boulevard and West of Beverly Hills, Culver City, and Inglewood (Figure II-157). A "hodge-podge" of communities with quilt boundaries, West Los Angeles is generally above average in "quality of life" attributes (Community Analysis Bureau 1975a).



198P-219

Figure II-157. Areas of West Los Angeles around Westwood are undergoing recycling from older, single-family residences to new multi-story, multi-family apartment complexes.

(a) Palms - Mar Vista - Del Rey. Median family income in these three communities in 1970 ranged from moderate to high (Community Analysis Bureau, 1975c). Home values in 1970 were mostly moderate ($20,000 to $35,000) in Del Rey, moderate to $50,000 in Palms (Community Analysis Bureau, 1975f). Population density is moderate to high in all three communities. Neighborhood ambience ratings are near average in Del Rey, average to high in Mar Vista, and average to high in Palms (Community Analysis Bureau, 1975a). Educational achievement is rated as average for most tracts, with some low achievement tracts in Palms and Del Rey, and some high achievement tracts in Palms and Mar Vista (Community Analysis Bureau, 1975d). The area is included in the City's low health priority group (Community Analysis Bureau, 1975c).

Ethnically these communities have more diversity than other outlying residential areas such as the San Fernando Valley and the Santa Monica Mountains. Only Del Rey, however, with a 46 percent non-Anglo population has a large minority representation. Some of the older, deteriorated housing in Del Rey and Palms is being demolished and replaced with apartment units. The development of the Marina Del Rey and the relocation of several light industrial firms into the area has lead to a recent surge of apartment and condominium construction.

(b) Venice. The oldest community in West Los Angeles, Venice today has low to middle income levels and 1970 median home values ranging from under $20,000 to beach-front homes in the $50,000 bracket. Most home values are in the $20,000 to $35,000 range. Population density varies from low to high and neighborhood ambience is on the low side (Community Analysis Bureau, 1975a). Educational achievement is from low to average, compared to other areas in the City (Community Analysis Bureau, 1975d). Venice is in the moderately high health priority area in Los Angeles (Community Analysis Bureau, 1975c). Ideally, with its extensive ocean front and artist's colony, Venice should be an attractive place to live; however, a cycle of deteriorating housing and haphazard industrial development has lead to a decline in the local "quality of life" (see Figure II-158).

(c) West Los Angeles - Westwood. Mature families, small households, and ethnic diversity are characteristic of these two communities. Incomes generally ranged from $7,500 to over $15,000 (Community Analysis Bureau, 1975e). In West Los Angeles, median home values were moderate to high with values in Westwood high to exclusive. Density is moderate to high. Neighborhood ambience is rated as slightly above average in West Los Angeles, and as high in Westwood (Community Analysis Bureau, 1975a). Educational achievement is average to high in West Los Angeles, and high in the university-oriented community of Westwood (Community Analysis Bureau, 1975d). Forty-five percent of Westwood's residents and 31 percent of West Los Angeles's residents over 25 have completed college (Community Analysis Bureau, 1975b). The area has low city health priority (Community Analysis Bureau, 1975c).

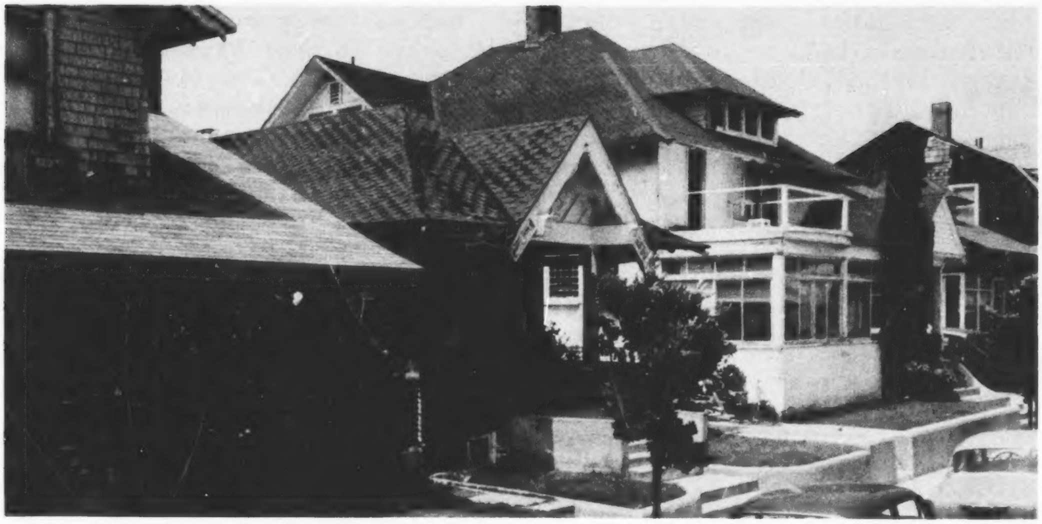


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Figure II-158. The Venice area has older homes on extensive ocean frontage. The cycle of deteriorating housing and the failure to determine what to do with the canals have led to a decline in neighborhood ambience.

Both Westwood and West Los Angeles have undergone an urban renaissance of sorts. In West Los Angeles this was aided by the development of Century City, a high-rise apartment, convention, and financial center. Westwood was renewed and developed as UCLA increased in importance (Community Analysis Bureau, 1975b). Today both communities possess certain high "quality of life" characteristics, but they are more likely to appeal to the affluent single or to the young working couple than to the established family group.

(d) Del Rey Palisades - Westchester. These two communities have both lost some population as a result of development of Los Angeles International Airport. In spite of proximity to the airport, much of this area has remained a middle and upper income area. Median incomes range from $7,500 to over $15,000 in Westchester and the ocean community of Del Rey Palisades has median incomes over $15,000 for all census tracts (Community Analysis Bureau, 1975e). Median home values for 1970 throughout Del Rey were likewise high ($35,000 to $50,000), whereas home values in Westchester ranged from moderate ($20,000 to $35,000) to high (Community Analysis Bureau, 1975f). Population density is low to moderate in Westchester, and low in Del Rey Palisades. Neighborhood ambience is above average in both areas (Community Analysis Bureau, 1975a). Educational achievement varies from near average to high among the area's census tracts (Community Analysis Bureau, 1975d). The area has few significant health problems.

(6) SOUTH LOS ANGELES. South Los Angeles, an area which includes the Harbor District and the Torrance-Gardena "shoestring", has a variety of residential environments located amid industrial, commercial and military development. In annual cargo value and tonnage, the Los Angeles-Long Beach Harbor area ranks second on the Pacific Coast only to the San Francisco Bay ports. Based on its canning industry, Los Angeles has long been the nation's leading fishing port. Wilmington Oil Field, California's leading producer, contributes further to the industrial-commercial atmosphere (Lantis, Steiner, and Kariner, 1973). The nearby industrial development provides most of the jobs in South Los Angeles, and an estimated 5 percent of total city jobs (Community Analysis Bureau, 1975e).

(a) Torrance - Gardena Corridor. The two corridor communities of Torrance and Gardena have much in common. Both were fringe areas during the 1940s. Large-scale growth, when it occurred in the 1950s was mostly in the form of single-family, owner-occupied dwellings. New residents were predominantly young, blue collar workers with families and with average educational attainment. Most had completed high school. Some white collar aerospace workers also settled in the Torrance-Gardena strip (Community Analysis Bureau, 1975b). The populations in the two communities remain young, and the percentage of minority residents is relatively high (56 percent in Gardena, 29 percent in Torrance). Although new living units are often multiple unit structures, the communities remain family-oriented. They continue to be attractive to lower and middle income workers.

Today the corridor retains its blue collar character. Family income generally ranges from $7,500 to $15,000 in Gardena. The income profile for Torrance is slightly lower, with some areas averaging under $7,500 (Community Analysis Bureau, 1975e). Home values in both communities are comparable, ranging from $20,000 to $35,000 (Western Economic Research Co., 1971). Population density is low to moderate, but extensive industrial land use reduces the sense of suburban spaciousness. In spite of industrial development, neighborhood ambience is average to above average. Educational achievement in both communities is rated at about the citywide average (Community Analysis Bureau, 1975d). Both communities fall within a moderately low priority health grouping (Community Analysis Bureau, 1975c).

(b) Wilmington - Harbor City. Proximate to the oil industry, the Wilmington-Harbor City area resembles other sections of South Los Angeles in its industrial orientation. Family incomes are low, under $15,000 throughout the area. Home values are also low (under $20,000) to moderate ($20,000 to $35,000). Neighborhood ambience is low, due chiefly to the proximate industrial and commercial activities (Community Analysis Bureau, 1975a). Educational achievement is near average for the City in the western part of the area, but falls below average in the eastern, older sections of the community. Wilmington-Harbor City are included within the City designated area of greatest health need (Community Analysis Bureau, 1975c). Ethnically, the Wilmington-Harbor City planning area is mixed with a large, widely distributed Spanish surname population, and local concentrations of Japanese and blacks (Lantis, Steiner, and Kariner, 1973) (Figure II-159).

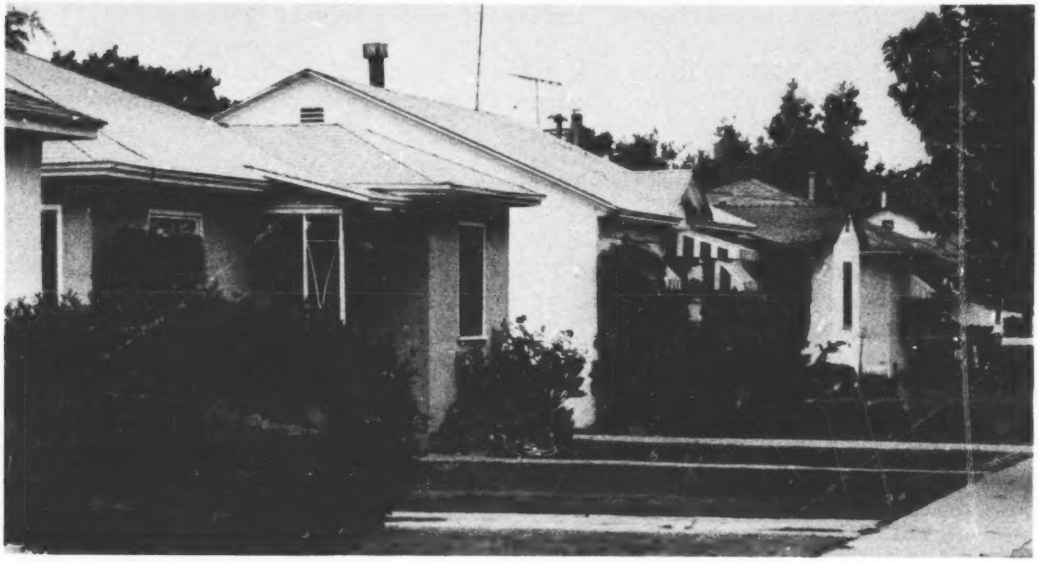
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Figure II-159. Relatively small residential units constructed during the 1940s are typical in the Wilmington-Harbor City area. Older sections of the area are designated by the City as having a need for health services.

(c) San Pedro. San Pedro, a colonial hide-and-tallow port, is today Southern California's focus for fishermen and fresh-fish marketing. Nautical equipage establishments, sailors' accommodations, the L.A. Harbor Commission, and branch city offices cluster near the waterfront (Lantis, Steiner, and Kariner, 1973). The residents of San Pedro have a wide range of incomes, home values, and educational achievement. Density and neighborhood ambience also vary greatly within the area (see Figure II-160). However, most of the high income, high "quality" development is concentrated in the southwestern corner of the area where upper income residents have built homes on terraces overlooking the sea. The San Pedro community is included in the moderately low health priority group (Community Analysis Bureau, 1975c). Ethnically, San Pedro is mixed, with a large Spanish surname representation.

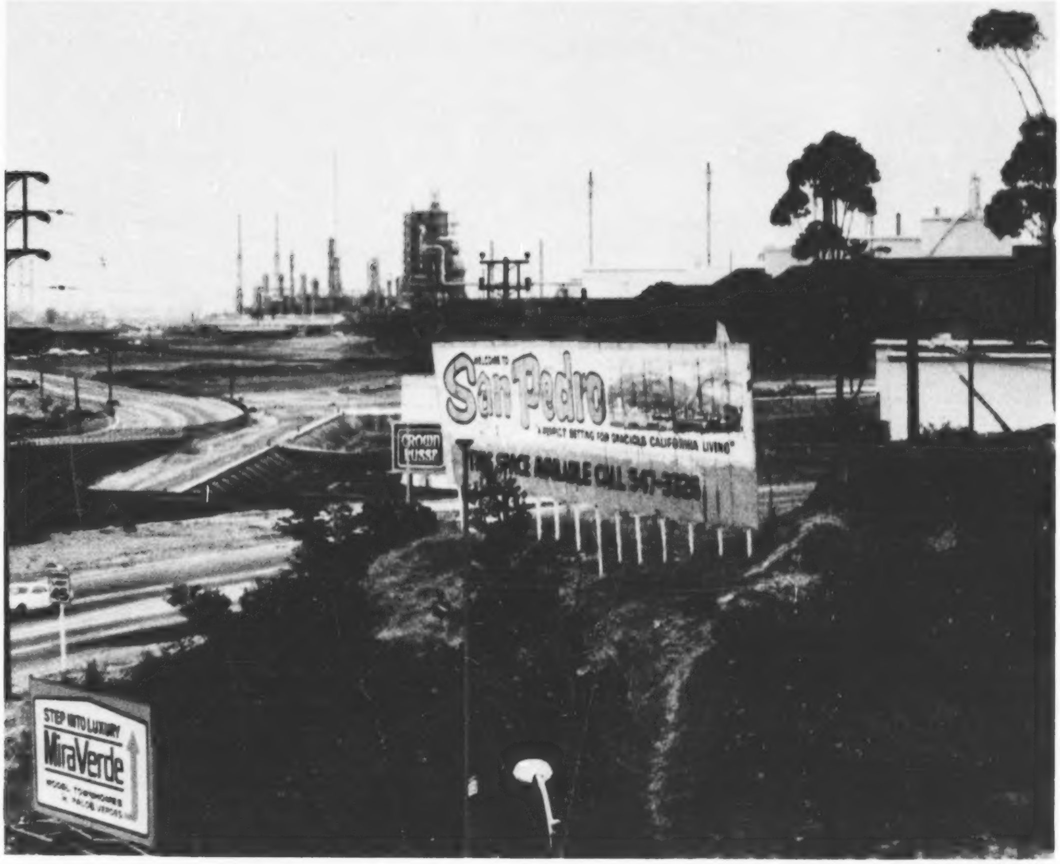

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Figure II-160. The San Pedro area borders heavy harbor industrial development and has a high degree of variability in density, income levels, educational achievement, and localized neighborhood ambience.

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